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TENTH ANNUAL CONVENTION

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

Held at

INDIANAPOLIS, INDIANA

October 20th, 21st and 22d,
1903

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PROCEEDINGS

OF THE

TENTH ANNUAL CONVENTION

OF THE

American Society

OF

Municipal Improvements

HELD AT

INDIANAPOLIS, IND., OCT. 20th, 21st and 22d,

1903

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B. E. BRIGGS	Erie, Pa.
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EXECUTIVE COMMITTEE

The officers of this Society, together with the Past Presidents who have retained their continuous membership, constitute the Executive Committee, the Past Presidents are as follows:

PAST PRESIDENTS

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E. A. FISHER	Rochester, N. Y.
C. H. RUST	Toronto, Canada

Standing Committees

Appointed by the Presinent in accordance with Article IV, Section 4, of the Constitution of the Society.

1903-1904

STREET PAVING

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FRED GIDDINGS	Atchison, Kansas
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REVIEW

PROF. A. N. TALBOT, Chairman	Champaign, Ill.
LESLIE V. CHRISTIE	Wilmington, Del.
WM. PIERSON JUDSON	Oswego, N. Y.

Special Committees

Appointed by the President in accordance with resolutions adopted by the Society.

MUNICIPAL DATA AND STATISTICS

WM FORTUNE, Chairman	Indianapolis, Ind.
J. W. HOWARD	New York, N. Y.
F. H. HAMILTON	Springfield, Ill.

PARK DEVELOPMENT AND MAINTENANCE

G. A. PARKER ,Chairman (Supt. Keney Park)	Hartford, Conn.
C. C. Laney, Supt. Parks	Rochester, N. Y.
THEODORE A. LEISEN	Wilmington, Del.

NOTICE

The Annual Reports for the former meetings are for sale by the Secretary at the following prices, including postage:

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AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

CONSTITUTION OF THE SOCIETY

ARTICLE I—Name and Object.

Section 1. The objects of this Society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon Municipal Improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II.—Membership.

Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer, or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work. When a municipality has become a member of the Society, then any person of such municipality representing any municipal board or department of any proper person interested in municipal improvements, who is not a contractor or contracting agent, may also become a member.

Any member who shall have ceased to have charge or supervision of any public or municipal department or work may retain his membership, unless he shall have come under the restrictive requirements of associate membership, when he shall retain membership as an associate only.

Sec. 2. Every application for membership shall be in writing, stating the name, location and department if any; and, if of an individual, shall also state age, residence and position of the applicant if any.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III.—Fees and Dues.

Section 1. Each municipality desiring to become a member of this Society may do so by the payment of five dollars admission fee, which will entitle said municipality to as many members to said Society representing boards or departments of said municipality as may be desired without any additional admission fee, but upon payment of the dues hereinafter prescribed.

Sec. 2. Municipalities shall not be required to pay any dues; but each individual representing any department of the municipality that has acquired a membership in the Society, or any associate member, shall pay five dollars per annum as dues, the same to be payable on or before the date of the annual meeting.

Sec. 3. Any person not connected in any official manner with any municipality, or any person applying for associate membership, shall, upon election, pay an admission fee of five dollars and the annual dues hereinafter prescribed.

ARTICLE IV.—Officers.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of a different state, and who with the Past Presidents who have retained their continuous membership shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following standing committees:

1. Street-Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any laibilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V.—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI.—Duties.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII.—MEETINGS.

Section 1. The annual meeting of the Society shall be held on the second Wednesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person of persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII.—ORDER OF BUSINESS.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Report of special committees.
9. Reading and Discussion of papers.
10. Election of officers.
11. Selection next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX.—AMENDMENTS.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vote of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the 1st day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain, from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

LIST OF CITIES HAVING A MEMBERSHIP IN THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS

Albany, N. Y.
Allegheny, Pa.
Akron, O.
Alton, Ill.
Atchison, Kan.
Bangor, Me.
Belleville, Ill.
Binghamton, N. Y.
Birmingham, Ala.
Bloomington, Ill.
Boston, Mass.
Bridgeport, Conn.
Brooklyn (B'gh) N. Y.
Buffalo, N. Y.
Burlington, Ia.
Calgary, Can.
Camden, N. J.
Champaign, Ill.
Chicago, Ill.
Chillicothe, O.
Cincinnati, O.
Cleveland, O.
Concord, N. H.
Covington, Ky.
Davenport, Ia.
Dayton, O.
Dubuque, Ia.
Duluth, Minn.
Dupont, Ga.
Easton, Pa.
East Orange, N. J.
Eau Claire, Wis.
Elmira, N. Y.
Elwood, Ind.
Erie, Pa.
Ft. Wayne, Ind.
Grand Rapids, Mich.
Guelph, Can.
Halifax, Nova Scotia.
Hamilton, Can.
Hamilton, O.
Harrisburg, Pa.
Hartford, Conn.
Indianapolis, Ind.
Jersey City, N. J.
Kalamazoo, Mich.
Lafayette, Ind.
Lima, O.
Little Rock, Ark.
Lockport, N. Y.
Los Angeles, Cal.
Louisville, Ky.
Mansfield, O.
Marietta, O.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
Mobile, Ala.
Montreal, Can.
Nashua, N. H.
Nashville, Tenn.
Newark, N. J.
New Bedford, Mass.
New Haven, Conn.
Newport, Ky.
New York, N. Y.
North Adams, Mass.
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Oswego, N. Y.
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Parkersburg, W. Va.
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Portland, Me.
Quebec, Can.
Quincy, Ill.
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Rochester, N. Y.
Rockford, Ill.
Saginaw, Mich.
Sheboygan, Wis.
South Bend, Ind.
Springfield, Ill.
St. Johns, N. F.
St. Louis, Mo.
St. Paul, Minn.
Syracuse, N. Y.
Toledo, O.
Toronto, Ont.
Urbana, Ill.
Washington C. H., O.
Washington, D. C.
Watertown, Wis.
Williamsport, Pa.
Wilmington, Del.
Youngstown, O.
Zanesville, O.

LIST OF MEMBERS

Adler, Arthur A., Chicago, Ill.
Adam, Ernest, Engineer Street and Sewer Department, Newark, N. J.
Allison, Robert, Board of Public Service, Cincinnati, O.
Alvord, John W., Consulting Engineer, Chicago, Ill.
Anderson, L. W., City Engineer, Grand Rapids, Mich.
Andrews, Horace, 51 State st., Albany, N. Y.
Ashley, B. J., Consulting Engineer, 1201 Michigan av., Chicago, Ill.
Ballard, Geo. M., Chairman Water Committee, Newark, N. J.
Barlow, John R., City Engineer, Montreal, Canada.
Barrow, E. S., City Engineer, Hamilton, Ont.
Bauman, C. V., Street Committee, Newark, N. J.
Benzenberg, Geo. H., Consulting Engineer, 436 Jefferson st., Milwaukee, Wis.
Boley, C. U., Engineer, Sheboygan, Wis.
Bouscaren, G., Chief Engineer Water Works Committee, Cincinnati, O.
Bradley, Arthur, Cleveland, O.
Briggs, B. E., City Engineer, Erie, Pa.
Brown, Charles C., Editor Municipal Engineering, Indianapolis, Ind.
Bruggeman, Henry, Mayor, Alton, Ill.
Chairman of Municipal Council, St. Johns, Newfoundland.
Chausse, Alcide, Building Inspector, Montreal, Can.
Christie, Chas. T., Mayor's Secretary, Cincinnati, O.
Christy, L. V., Secretary Street and Sewer Dept., Wilmington, Del.
Clark, Alfred, Commissioner of Highways, Concord, N. H.
Cochrane, L. Y., Superintendent of Highways, Allegheny, Pa.
Conkling, Leo D., City Engineer, Elmira, N. Y.
Crandall, Wm. S., Editor Municipal Journal, New York City.
Crane, James, Board of Control, Toronto, Can.
Devereux, Harry H., Mayor, Springfield, Ill.
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Fortune, Wm., Indianapolis, Ind.
Freiberg, M. J., Waterworks Commission, 216 E. Front st., Cincinnati, O.
Fulton, D. L., Director of Public Works, Allegheny, Pa.
Garrison, W. C., Newark, N. J.
Giddings, Fred, City Engineer, Atchison, Kan.

Glore, W. H., Superintendent Waterworks, Covington, Ky.

Greathead, Wm. E., Clerk Board of Public Works, Newark, N. J.

Hamilton, Frank H., City Engineer, Springfield, Ill.

Hatton, T. Chalkley, City Engineer Street and Sewer Dept., Wilmington, Del.

Hazelhurst, J. N., Mobile, Ala.

Herrmann, August, President Wateworks Commissioners, Cincinnati, O.

Holloway, C. M., Waterworks Commissioner, Cincinnati, O.

Howard, J. W., Consulting Engineer, No. 1 Broadway, New York, N. Y.

Howe, W. B., City Engineer, Concord, N. H.

Hutcheon, James, City Engineer, Guelph, Ont.

Johnson, Edward J., City Engineer, Nashua, N. H.

Jones, John, Superintendent of Streets, Toronto, Ont.

Judson, Wm. Pierson, Deputy State Engineer, Albany, N. Y.

Kendrick, Julian, City Engineer, Birmingham, Ala.

Ker, N. I., City Engineer, Ottawa, Can.

Kerm, Fred J., Mayor, Belleville, Ill.

Kiefer, Edgar S., Board of Public Works, Grand Rapids, Mich.

Kummer, F. J., General Manager U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Langenheim, G. C., City Engineer, Allegheny, Pa.

Leisen, Theo. A., Wilmington, Del.

Lewis, N. P., Chief Engineer Board of Estimate and Apportionment, New York City.

Logsden, Edwin D., Board of Public Works, Indianapolis, Ind.

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McCartin, J. M., Street Commissioner, Birmingham, Ala.

McClintock, John M., Consulting Engineer, Boston, Mass.

McClintock, J, Y., Commissioner of Public Works, Rochester, N. Y.

McComb, D. E., Superintendent of Sewers, Washington, D. C.

McCrea, E. W., General Agent Buffalo Pitts Roller, Buffalo, N. Y.

McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.

McMillan, Chas., City Clerk, Calgary, Canada.

Magley, Wm., Board of Public Service, Cincinnati, O.

Markbreit, L., Waterworks Commission, Cincinnati, O.

Mead, D. W., 605 First National Bank Bldg., Chicago, Ill.

Melish, Wm. B., Waterworks Commission, Cincinnati, O.

Mundy, J. Crowell, General Superintendent of Works, Newark, N. J.

Murphy, M. W., Councilman, Burlington, Iowa.

Nelson, Jas. B., Manager Merchants' Heat & Light Co., Indianapolis, Ind.

Neville, Thos., Deputy Commissioner of Public Works, Rochester, N. Y.

O'Brien, F. J., Street Commissioner, Oswego, N. Y.
Parker, G. A., Superintendent Keney Park, Hartford, Conn.
Phinney, F. J., Superintendent Water Works, Rockford, Ill.
Pierce, Geo. M., Cleveland, O.
Pollock, Clarence D., Assistant Engineer Bureau of Highways, Brooklyn, N. Y.
Putmann, J. E., Consulting Electrical Engineer, Rochester, N. Y.
Radenhaurst, Wm. N., Rochester, N. Y.
Rankine, E. S., Engineer Sewer Department, Newark, N. J.
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.
Reichardt, Walter F., Assistant City Engineer, Little Rock, Ark.
Reimer, W. H. V., City Engineer, East Orange, N. J.
Richey, A. D., City Engineer, Elwood, Ind.
Rowson, John W., Board of Public Works, Grand Rapids, Mich.
Rust, Chas. H., City Engineer, Toronto, Ont.
Sherrerd, M. R., Superintendent Waterworks, Newark, N. J.
Skinner, John F., Waterworks Assistant, Rochester, N. Y.
Snyder, Frederick A., care Essex Union Water & Light Co., Summit, N. J.
Steece, Emmet, City Engineer, Burlington, Ia.
Stewart, Wm. J., First Assistant City Engineer, Rochester, N. Y.
Stobaeus, J. B., Member Board of Trade, Newark, N. J.
Strain, Jas. H., Manager Oastler Road Roller, 441 First st., Brooklyn, N. Y.
Thompson, A. D., Peoria, Ill.
Tillson, Geo. W., Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Vinson, J. S., Newark, N. J.
Weil, Samuel, Jr., Board of Public Service, Cincinnati, O.
Williams, Chas. E., Director Public Works, Bridgeport, Conn.
Woods, F. H., Chairman Commission on Works, Toronto, Ont.

GEORGE M. BALLARD

Commissioner, Board of Public Works, Newark, N. J.
President, American Society of Municipal Improvements.

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AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

TENTH ANNUAL CONVENTION

Indianapolis, Ind., October 20, 21 and 22, 1903

TUESDAY, OCTOBER 20.

Annual Convention of the American Society of Municipal Improvements, held in the Assembly Hall of the Commercial Club, in the City of Indianapolis, Ind., October 20, 1903, at 2:30 o'clock P. M.

The meeting was called to order by President Rust, who in introducing Judge Gavin, said. "On behalf of the Convention it gives me great pleasure to introduce to you Judge Gavin, who will deliver the address of welcome."

MR. PRESIDENT, LADIES AND GENTLEMEN: To me has been assigned the very pleasant task of voicing to you the welcome which Indianapolis most cordially and sincerely extends to you. We give you welcome because you represent progress and improvement, because upon you devolves the duties of laying out the parks, streets and public improvements which are of such great benefit to the communities in which you labor. That the welcome which we give you is cordial and warmly felt I can most sincerely assure you. For your benefit, and to give you welcome, Indianapolis has put on her most beautiful garb. The sun shines, and with a warmness that is meant for your especial benefit. Not a cloud is to be seen.

We have for your benefit at the waterworks system under construction a filtration plant that is said to be one of the amplest of its kind, and the most complete. We have a waterworks system which, as to its machinery and pumping apparatus, is the largest of its kind in the Nation, and I think I can vouch for the proposition that it is the biggest of its size to be found. We have the most complicated system of crossings that are now being put in at Washington and Pennsylvania Streets, and that are still left open that you may have the special advantage that may be derived from the complete inspection of them. In addition to that we have in the course of construction a system of heating apparatus left open for your inspection in order that you may see that the work is being rightly done. All these are for your especial benefit and to emphasize the welcome which we would give to you. Is all seriousness, we, as citizens of Indianapolis, very strongly appreciate the work in which you are engaged. We know how much the welfare of the city depends upon the ability and industry of the workmen who have the work in charge. We understand that you stand for the progress and improvement in all of the best physical development of our communities, and we look to you for help in this direction. There are some things to which we hope to find an answer: We would like to know how to find an inspector that will inspect; we would be very much pleased to find a street sprinkler that will allay the dust and not make muddy thoroughfares. These, and many other things, we would like to know from you.

We trust that your meeting will be a success, and when it is over we are very sure that we will have derived pleasure and profit from your coming.

MR. BALLARD, of Newark, the Vice-President, responded to address of welcome as follows:

MR. PRESIDENT: I have been delegated by our President on behalf of our Association, to sincerely thank you for your warm and cordial welcome. The poet has well said, "Some men are born great; others have greatness thrust upon them," and while I am sure that I have not been born to greatness I must therefore conclude that greatness has been thrust upon me. A year ago I was selected by our President to respond to the welcome of the Mayor of the beautiful city of Rochester. I am unable at this time to explain why I have again been selected, for I had supposed that after my feeble efforts on that occasion that one such failure should have sufficed for all time. My position, as I understand it, can better be described by a short story. A poor widow was the owner of a miserable cur that at the very presence of a man would sit on the step and bark continually. It annoyed a neighbor very much, and out upon the street one day he told about the peculiarity of the dog in barking at the men.

The friend replied, "Well, what of it?" "Well, nothing, but the man moves on." And, perhaps, now like the man and like the dog's bark, I am to go on forever and ever.

Now, as to our Association, it is composed of representatives of different sections throughout the country and Canada. The object of this, our Association, is to consider matters of interest to the benefit and welfare of our localities. Since our inception much has been accomplished that has been of great benefit to our municipalities, and we shall continue to go on with that work believing that as we shall proceed from time to time that our efforts will show that we do something to benefit the different municipalities which we represent.

And now in conclusion, Mr. President, I again thank you for your generous and kind welcome. We shall very much regret that we are obliged to part with you in a very short time and that we shall so soon have to force ourselves to leave the generous hospitality which you have extended to us. We are not here for speech-making, but for business. During previous meetings great good has been accomplished, and I look forward to this meeting of 1903 to bear still greater fruits and to show that this organization is what might be termed alive and up-to-date. I thank you.

The next in the order of business was the roll call, but a motion to dispense with this was carried.

A motion to dispense with the reading of the minutes of the last meeting was also carried.

The next address was that of the President, which is as follows:

MEMBERS OF AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

LADIES AND GENTLEMEN: The Tenth Annual Convention of this Society marks the first decade in its history, and it is my purpose to touch briefly upon the improvements in municipal engineering since its organization, as well as other matters relating to municipal government, which may be of interest to the members.

For the first time in the history of the Society the President's chair has been filled by a Canadian, and I desire to express my appreciation of the honor conferred upon me.

When this Society was formed ten years ago, there were many who doubted of its success, but I think we have proved that it has been a potent factor in bringing about improvements in municipal administration in all our cities and towns, and has resulted in a more frequent interchange of opinion between municipal officers, who are thus kept closely in touch with the most modern methods employed in all branches of municipal government. The various papers that have been presented at the annual meetings, and the discussions resulting therefrom, have been of a very high character. It is necessary that we should impress upon all municipalities the advantages derived from attending our conventions, and the importance and usefulness of this Society, which are clearly demonstrated by reading the reports and discussions of our Proceedings throughout the different years.

Although our membership roll has increased satisfactorily, the increase would have been much greater had it not been for the formation of similar organizations. At the convention held last year in Rochester the question of amalgamation with other municipal societies was discussed, but the consensus of opinion among the members was opposed to such a course. We might, however, consider the advisability of holding our convention at the same time and place as the League of American Municipalities, which met in Baltimore during the first part of this month. This Society, I understand, represents largely the legislative branch of our municipal government. Notices of our meeting were issued to the mayors and other municipal officers of all the large cities and towns in the States and Canada, inviting them to attend this convention, and a number of the mayors replied to the effect that they had arranged to be present at the convention of the League of American Municipalities, and regretted their inability to attend both meetings.

Referring to the advances made in municipal engineering during the past ten years, the electric street railway system has been universally adopted by all cities and large towns, and by means of interurban roads, cities, towns and villages have been brought in close touch with one another. Owing largely to the method of construction and the low cost of the right-of-way, interurban companies have been enabled to charge lower rates than the steam railway companies, with the resultant effect of so reducing the receipts of the steam roads that in many cases the running of local trains has been almost entirely discontinued. From the experience of the past ten or twelve years it has been found advisable to use a much heavier type of rail than was originally laid. The practice now in vogue is to lay the rails upon a solid bed of concrete, using iron tie bars, wooden ties being entirely dispensed with. Regarding the type of rail, when this matter is left to the decision of the city authorities, a grooved, girder rail is usually selected, and experience has proved this to be the most satisfactory style of rail, especially upon paved streets. The street railway officials, however, prefer the T rail, but it is found very difficult to maintain the pavement next the rails when this type is used.

Shortly after the installation of electric roads it was discovered that, owing to the rails not being properly bonded, electrolytic action took place and in some cities serious damage has been done to water and gas pipes.

The construction of the overhead trolley system has resulted in further aggravating the evil of overhead wires. The trolley wire is not as objectionable as the large number of feed wires which are required, and I am of opinion that all municipalities should now insist upon these wires being placed underground.

During the past decade the question of sewage disposal has been brought prominently before municipalities, and as a result of very extensive experiments, the method of precipitation by chemical means will probably be superseded by septic tanks and contact beds. Some of the large European cities have been experimenting for a number of years with this form of treatment, and sufficient data has been obtained to warrant the construction of permanent works. Manchester was the first large city in England to adopt septic tanks and bacteria beds. The first cost is excessive, and unfortunately we have not sufficient information before us to arrive definitely at the annual cost, but it will probably range from $1.50 to $3.00 per million gallons. The great advantage of this system is the reduction in the amount of sludge to be disposed of and the high degree of purity that can be obtained by treatment upon contact beds after septic action. If a first-class effluent is not desired, septic tank treatment may be found sufficient. Every city, of course, is a special study in itself, and where suitable soil can be obtained at a reasonable cost, I am of opinion that land treatment after septic tank action will be found the most satisfactory method of disposal in this country.

Considerable progress has also been made in the method of constructing pavements and sidewalks. In laying pavements the question of freedom from noise, as well as durability, should be carefully considered, for in business centers property owners would prefer to pay more for a noiseless pavement, even if the lifetime is not as long. The ideal city pavment is block or sheet asphalt, or rectangular, wooden blocks, treated with a preservative and laid upon a concrete foundation. The question of the advisability of requiring a long term of guarantee upon pavements has been a source of discussion among engineers, many considering it undesirable to demand a guarantee of more than one year, while others are of the opinion that a municipality is better protected and it is more probable that first-class material will be used, if a guarantee of five or ten years is required upon all pavements laid on a concrete foundation. As the tendency in cities and towns is to construct pavements of a costly nature, it has become customary to build narrower roads than formerly, in order to reduce the cost. In some cities the general width for residential streets is twenty-four feet.

As the use of soft coal in manufacturing cities is now almost universal, the smoke nuisance has become a great evil. Although several cities have passed ordinances to prevent this trouble, I understand it has been found difficult to enforce them.

The question of garbage disposal has come prominently to the front within the past few years, and we have much to learn from European cities in this respect. It is one of the most important matters in municipal administration, as the health of the community depends largely upon the proper disposition of waste material.

One of the most important questions of the day, and one which has attracted great attention, not only from municipal officers, but from the public generally, is the municipal ownership of public franchises. There is no doubt that every city should own and operate its own waterworks system and lighting plant. Unfortunately, during the past few years, if we may believe the public press, attempts have been made by capitalists, sometimes successfully, to corrupt both state and municipal corporations, for the purpose of obtaining public franchises, which condition of affairs would be entirely abolished if these were owned by the municipality.

A short time ago there was some discussion in the press upon the best method of appointing city engineers. In Canada the City Council appoints the municipal officers during good behavior, which system has been found to work satisfactorily. This is also the universal custom in England, and it appears to be to be preferred to the suggestion that the engineer be elected by the citizens. I am of opinion that an official cannot be a good engineer and in addition devote his time to politics. One of the difficulties and drawbacks to the more successful administration of public affairs in American cities is the frequent change of officers, caused by the almost universal introduction of politics into municipal government. This is a matter much to be deplored.

The prevention of the lavish and unnecessary use of water in our cities is a matter desiring the earnest consideration of municipal officers. In European cities 40 to 50 gallons per head per diem are considered sufficient for all purposes, and in some American cities 150 to 200 gallons per diem are used. Where water meters have been universally installed the result has been most satisfactory, the consumption being reduced 65 to 75 gallons per head per day. Although the first cost is very heavy, the saving effected more than compensates for the outlay.

In conclusion I desire to thank the chairmen of the various Committees for their hearty co-operation during my term of office, and the members of the Local Committee for their earnest efforts to make our meeting both instructive and pleasant. I also wish to express my appreciation of the kindness of those gentlemen who have prepared the various papers to be read at this convention, and to congratulate our Secretary upon the very efficient manner in which he has looked after the interests of the Society.

PRESIDENT RUST: The next order of business will be the selection of a Committee on Nominations.

On motion of Mr. Sherrerd, seconded by Mr. Ballard, the selection of a Nominating Committee was deferred until Wednesday.

SECRETARY G. W. TILLSON made the following report:

REPORT OF THE SECRETARY.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

GENTLEMEN: I herewith submit my report for the years 1902 and 1903:

Receipts—

Dues	$365.00
Initiation fees	5.00
From advertisers	312.00
From sale of reports	30.50
Total	$712.50

Amounts paid to Treasurer—

October 7, 1902	$215.00
December 17, 1902	87.00
April 15, 1903	46.50
June 1, 1903	226.75
July 28, 1903	57.00
October 16, 1903	75.25
Cash on hand	5.00
Total	$712.50

The receipts from the advertisers and the sale of the Proceedings will nearly pay for the printing of the same, although the amount of advertising was not as large as in the previous year.

During the year I have attended to the correspondence of the Society, and have prepared the annual publication for the printer, a copy of which was sent to each member of the society early in the year.

About two months previous to the present meeting, a copy of the Proceedings and a circular signed by the President was sent to the city engineers of all the principal cities of Ohio, Indiana, Illinois, Wisconsin and Michigan. The object of this was to call the attention of these officials to the work of the society and also to the coming meeting. The developments of this meeting must show whether this work will bear any fruits.

Two postal card notices of this meeting have been sent to all members of the Society, one about two months ago and the other about two weeks previous to the meeting.

The Secretary wishes to thank all the officers of the Society for their hearty co-operation with his labors, without which he could have accomplished very little.

Respectfully,
GEO. W. TILLSON,
Secretary.

On motion of Mr. Ballard the report was received and referred to the Committee on Finance.

The Treasurer's report was then read, as follows:

REPORT OF THE TREASURER.

OSWEGO, N. Y., Oct. 17, 1903.

TO THE HONORABLE THE FINANCE COMMITTEE, AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, INDIANAPOLIS, IND.

GENTLEMEN: I have the honor to submit the following report of receipts and disbursements for 1902-1903:

Receipts—

Balance Oct. 6, 1902	$165.95	
Received from G. W. Tillson, Secretary	707.50	
		$873.45

Disbursements—

1902.			
Oct. 9.	G. W. Tillson, salary, Secretary	$100.00	
	G. W. Tillson, disbursements	37.61	
13.	Union Advertising Co., printing	4.50	
	Rochester Printing Co., printing	31.65	
14.	E. A. Fisher, disbursements	19.40	
Dec. 10.	F. W. Parkhurst, services, stenographer	105.40	
1903.			
June 1.	S. E. Tate & Co., account printing	200.00	
5.	S. E. Tate & Co., balance printing	158.39	
8.	Receipted bill, S. E. Tate & Co	20.00	
	Exchange on checks	3.25	
	Balance Oct. 17, 1903	193.25	
			$873.45

Yours very respectfully,
F. J. O'BRIEN,
Treasurer.

On motion of Mr. Fisher the Treasurer's report was received and referred to the Finance Committee.

PRESIDENT RUST: The next thing in order is the report of the Committee on Municipal Data and Statistics. The report will be made by the chairman of that committee, Mr. Charles C. Brown, of Indianapolis.

REPORT OF COMMITTEE ON UNIFORM MUNICIPAL REPORTS AND ON NATIONAL STATISTICS.

THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

GENTLEMEN: Your Committee on Uniform Municipal Reports and on National Statistics has the following report to make:

In accordance with the instructions of the Society, the chairman of the committee went to Washington and interviewed the chief clerks in charge of the departments which are collecting municipal statistics. This visit happened to be at the time that the Department of Commerce was in process of formation. It was learned that the Census Department was to become a bureau of the new Department of Commerce and Labor and that the Department of Labor also became a part of the new department. This new department places practically all the efforts toward the collection of data under one department, with consequent co-ordination and concert of effort. The chairman of your committee had a conference with William C. Hunt, the Chief Statistician for Population of the Bureau of the Census in the Department of Commerce and Labor, who has thus far had charge of the development of methods of work under the new management, and has had some correspondence with him since the conference. The result up to date is expressed in the following letter from Mr. Hunt recently received:

WASHINGTON, Oct. 14, 1903.

Mr. Charles C. Brown, Municipal Engineering Company, Commercial Club Building, Indianapolis, Ind.

DEAR SIR: I have your letter of the 5th instant, and in reply woul state that after we had sent the schedule for cities to the printer it determined by the Director, and upon his recommendation so order the Secretary of Commerce and Labor, to postpone the collection of tics until some time early next year. Practically the entire for office is to be utilized in the near future in the compilation of pine census returns, and until the bulk of that work is ou nothing much can or will be done with reference to the col statistics. It is the purpose, however, to begin work early in 1904, by March possibly, and from the date of commencement to prosecute the work actively to its completion in all its details.

Very respectfully,
WM. C. HUNT,
Chief Statistician for Population.

With regard to the subect of National Statistics, it may be added that Mr. Hunt is impressed with the value of recommendations from the American Society of Civil Engineers, and was, at the time of the conference, awaiting the receipt of letters in continuance of a rather desultory correspondence with some committee of that society. Correspondence with the members of that society named by Mr. Hunt revealed the fact that there was no very definite consideration of the subject under way. Letters were written to persons now and formerly in charge of the matter, but with no very definite result. We believe that the census officials will proceed without the assistance of the American Society of Civil Engineers if it is not forthcoming at the proper time. The forms which this Society has adopted have been presented in the fullest manner possible, both to the Chief Statistician having the matter in charge and to the persons in the American Society of Civil Engineers, and will doubtless receive the consideration which the adoption of this Society entitles them to.

The forms which were presented to this Society by this committee last year have been before the members since the printing of the volume of Proceedings, and are again presented for the further action of the Society. They were sent to the members of the American Society of Civil Engineers referred to with the request that any modifications which they might have to suggest be sent before this meeting, but none have been received. This probably means that the committee has not yet considered the matter sufficiently to be ready to recommend forms to the Census Bureau or to know whether those presented for their consideration are in form satisfactory to them. We have enough experts in these lines to insure that forms adopted by this Society are the best forms for its puposes, and careful consideration with modification, if necessary, and recommendation at this meeting is suggested that they may express to the Census Bureau the views of this Society, which is undoubtedly the Society most interested in the matter and most competent to determine the forms of municipal reports to make them of practical value. It is not expected that the Census Department on its collection of statistics will use all of the forms which have been or may be adopted by this Society. All that has been suggested to that Department is that the forms used be in conformity adopted by this Society, that the requests for statistics by the

Government may be an additional incentive to the adoption of the uniform form on account of the greater ease of compliance with the Government's request for information. The Appendix gives the forms proposed for consideration at this meeting in the form offered last year.

APPENDIX.

NOTE—The following forms were not adopted, but were ordered printed with the committee report for further consideration by the Society:

MISCELLANEOUS MUNICIPAL STATISTICS.

Public Parks.

Number and acreage of each owned by city.
Number and acreage of other parks.

Street Railways.

Miles of line.
Miles of track.
Number of cars.
Kind of power.
Number of employes.

Street and Alley Cleaning.

Miles and square yards streets cleaned.
Miles and square yards cleaned by hand only.
Miles and square yards cleaned by machinery.
Miles and square yards cleaned by both hand and machine labor.
Miles and square yards cleaned by city.
Miles and square yards cleaned by contract.
Miles and square yards cleaned daily.
Miles and square yards cleaned three times a week.
Miles and square yards cleaned twice a week.
Miles and square yards cleaned weekly.
Miles and square yards cleaned less frequently.
Miles and square yards of paved streets cleaned.
Miles and square yards of unpaved streets cleaned.
Total miles of streets in city.
Average number of persons employed by city.
Average number of persons employed by contractors.
Total cost of hand-cleaning for year, \$——, per square yard str
Total cost of machine-cleaning for year, \$——, per square yar
Total cost of combined cleaning for year, \$——, per square y
Total cost of all cleaning for year.
Contract price, if any.

Garbage and Refuse Disposal.

Number of inspectors.
    food.
    sanitary.
Tons of ashes disposed of
    By city.
    By contractors.
Tons of garbage sold
    By city.
    By contractors.
Tons of garbage burned
    By city.
    By contractors.
Tons of garbage otherwise disposed of
    By city.
    By contractors.
Dead animals and other refuse
    Tons sold by city.
    By contractors.
    Tons burned by city.
    By contractors.
    Tons otherwise disposed of by city.
    By contractors.

Average number of persons employed in removal of ashes, garbage and other refuse
    By city.
    By contractors.

(If accounts are kept in loads, state average weight of each load of each class of garbage and refuse above named.)

Street Lighting.

Number of lights.
Electric arc open, ——; inclosed, ——; incandescent, ——.
Gas, ——; Welsbach, ——; other, ——.
Vapor lamps, ——.
Oil lamps, ——.

Respectfully submitted,
CHARLES CARROLL BROWN,
For the Committee. Chairman.

On motion of Mr. Sherrerd the report was received, and the committee was requested to confer further with the census department of the Bureau of Commerce and Labor.

A. PRESCOTT FOLWELL

Professor Civil Engineering, Easton, Pa.

First Vice-President, American Society of Municipal Improvements.

PRESIDENT RUST: The next thing on the program is the report of the Committee on Municipal Franchises. Mr. Crandall, the chairman of that committee, is not present, but we have a letter here which our Secretary will read.

SECRETARY TILLSON read the following letter:

NEW YORK, Oct. 17, 1903.

Mr. C. H. Rust, President American Society of Municipal Improvements,
Indianapolis, Ind.

MY DEAR MR. RUST: It is with deep regret that I am obliged to absent myself from the meeting of the Society, but also to confess my inability to prepare the report of the Committee on Municipal Franchises in time for the meeting. This is due to the fact that I have been ill for more than a week—just the time which I had allotted for the final drafting of the report. I have had a nervous breakdown, according to the doctor's diagnosis, and he has insisted upon the relinquishment of several of my outside responsibilities, including the secretaryship of several organizations. I speak of this simply to show you that I have not been negligent of the Society's interests.

For several months, I have been gathering data upon the franchise question from American and Canadian cities. I have on hand a large amount of information which is very valuable, and only awaits the time when I can compile, classify and arrange it into a report. Necessarily, it will be three or four weeks before I can hope to do anything with it. If the Society wishes me to put the matter in the form of a report and send it to the Secretary at the earliest date possible, I will do so. If it wishes to continue the committee in its present form, I will undertake to continue the work during the coming year, but do not feel in the least obliged to so continue me, for my feelings will in no way be hurt if I am dropped from the committee, and released from all responsibility.

I wish you would convey to the members my sincere regret for thus failing to perform the duty imposed upon me, and assure them for me that it is only because of illness that I failed to do so.

With best wishes for the success of the session, I remain,

Sincerely yours,
WM. S. CRANDALL,

PRESIDENT RUST: There is one portion of that letter we might consider. Mr. Crandall says he has on hand a large amount of information which he considers very valuable. Would it not be as well to have that information sent to the new President? It could be incorporated in the report of the Society.

On motion of Mr. Adam, seconded by Mr. Fisher, the Secretary was requested to ask Mr. Crandall to forward the information to the incoming President.

PRESIDENT RUST: That is all we had on the program for this afternoon. Are there any other papers that can be read at this session? I understand some papers have been prepared which are not mentioned in the program. If so, and the writers of such papers are present, we might hear them now.

MR. FISHER: I don't think any of the regular papers on the program should be read, but if we have volunteers this would be a good time to hear them. However, I hope that when we start with the business of the convention to-morrow we will follow the old established rule of going ahead with the business when we have once commenced. By doing this we have usually been able to get away earlier than the time set in our program.

MR. BROWN, Indianapolis: We may be able to fill in the time this afternoon pretty well, even if we have nothing further on the regular program. We will have a ride about the streets of the city to-morrow afternoon. There is one thing we would like to have you do before you go on that ride, and that is to take the trip up the monument. This will give you a better idea of the route you will take and the portion of the city you will see. Several can go up at a time. We intend to have someone there all the afternoon to explain the points of view, and also point out the route of the excursion to-morrow. This evening we will have a banquet, and we expect everyone to assemble here in this room at seven o'clock.

The trip to-morrow afternoon will be by brakes and carriages. The ladies are especially invited to go on that trip. The route will be over the northern part of the city; and we will show you so
of our nicest streets and the different kinds of pavement. We
have ready for distribution cards giving the route, the de
the pavements, the age of the pavements all the way thro
a statement of some of the objects of interest that we

way. We will stop and examine pavements, and also stop to examine the filter beds and pumping station.

Wednesday evening we will have a program which we think will be interesting to the ladies also. It is in one sense an engineering program, because several of the papers are prepared by engineers who are acquainted with the general engineering features of the city; but it will be illustrated with views of the different parts of the city, and will show the improvements of the city, both completed and under construction. We hope it will give you a good idea of parts of the city not seen in your trip in the afternoon.

Mr. **Ballard**: This is a very pleasant program laid out by Mr. Brown. I have no doubt it is very pleasing to every member present, but it is a strong reason why we should go ahead with our business when we come together and transact as much as possible of it while we are in this room. It will be very pleasant for us to visit the places Mr. Brown mentions, but we must go ahead with our work regardless of the program and finish as much as possible of it, starting in with to-morrow morning.

Mr. Christie: Why is the business of the nominating committee postponed until to-morrow?

Mr. Sherrerd: I made the motion because I thought it only proper that the members of the Society from cities not yet represented should have an opportunity to be on these different committees, and particularly that they should be represented on the Nominating Committee. A great many members will be here to-morrow morning who have not been able to reach the city for this session. For that reason I thought it better to wait until to-morrow when other members will be here.

Mr. McClintock is present, and I think he has a paper prepared. We might have that read this afternoon.

President Rust: If Mr. McClintock has his paper here we will hear it at this session.

Mr. McClintock read the following paper:

THE MODEL CITY.

BY JOHN M. M'CLINTOCK, BOSTON, MASS.

The model city of the world to-day is the American city; not because it is built of brick and stone, where the fire apparatus is carried on a man's back, and a fire seldom gets beyond the room in which it starts, as in Italy; not because architectural uniformity is regulated by law, as in Paris: not because of many features adapted to European conditions but unsuitable in this country: it is the model city because it is inhabited by self-governing American citizens, who make their own laws, choose their own rulers and magistrates, and seek to keep their city in the van of progress. It is a growing city; it is not hemmed in by walls. It invites the invasion of the stranger, and assimilates him. It may have started in the recent past as a country village; and, by its advantages of site for trade and commerce, has drawn to it American citizens. Some fine morning it awakes and finds itself a pushing American city. The village buildings gave way to city structures; paved streets take the place of country roads; parks are laid out; water is brought in; sewers are constructed; the public library, bath-house, and gymnasium are built, and the city starts in the race, not as a rival to New York and Chicago in importance, but to excel in all things that make a city attractive. The people strive to improve the civic conditions of the model American city; hence the formation of the American Society of Municipal Improvement.

There is yet room for improvement in our cities along the lines of education, architecture, civil engineering and sanitation; socially, morally, and politically. To illustrate my idea, I call attention to the following figures from the Monthly Bulletin, for August, 1903, of the New York State Department of Health.

In the Maritime District, including Greater New York and nearby cities, in August of this very year, the percentage of deaths under five years of age was 41.5; at seventy years and over, 8; and from zymotic diseases, 26.

In the West Central District, including Auburn, Ithaca, Geneva and several large towns, the percentage of deaths under five years of age, was 20; at seventy years of age and over, 32.5; from zymotic diseases, 15.

In other words, in the city where there are hospitals, trained nurses, doctors, and drug stores on every hand, the infant mortality is twice as high as in the small city and in the countryside. While country life duces to old age there are very few people in the city who reach th of seventy years, only eight in one hundred; and, while zymotic can be treated and prevented better in the city than in the coun are nearly twice as many fatal zymotic cases in the city as in

A society for municipal improvement cannot ignore this subject. There must be improvement in this line. It is a task that must be done, not by the physician and the Board of Health, but by the city government and through the city engineer. It is a municipal problem and an engineering problem.

The doctor tells you that most zymotic diseases, like typhoid fever, for instance, are carried to their victims by drinking water and are spread again by unsanitary conditions. In most of the great cities in this country, to-day, the wealthy and educated classes will not use the water that is furnished through the city mains.

The great epidemic of cholera in Hamburg, in 1898, came from the death-bearing city water; as well as many of the plagues and pestilences in history, now with good reason ascribed to the same cause. The deadly typhoid is everywhere. Let it infest the water supply of the city; and these escaping from one case within the city's water-shed is sufficient; and an epidemic, like that at Ithaca, last year, may be the result. The press this fall have stated that the school children of Chicago are forbidden by the authorities to drink the water furnished by the city. The officials of Albany provide themselves with spring water. Special spring waters are sold throughout the country.

At a recent conference with the officials of a large city, which prides itself on the purity of its water supply, an expert of wide experience and great knowledge on the subject, and a citizen of that city, informed them that the water in their reservoir is not as pure as that of many cities in England and Europe before it receives treatment for purification. Such is the best practice in Europe to-day; and progressive America should not be in the rear.

The model American city should furnish for domestic use, water not only good, but above suspicion; and it *can* do so. This is a physical municipal improvement that is demanded in nearly every American city to-day. It is an improvement in the conditions effecting the public health.

Although the water supply may not be responsible for all the sickness ascribed to it, it is known positively to have caused the spread of epidemics in Lowell, Lawrence, Newburyport, Albany, Philadelphia, several cities about the Great Lakes and in many places throughout the Union.

The purification of water has become an absolutely fixed science; the presence of contaminating matter can generally be determined; and the problem resolves itself into what system or method of purification, if any, shall be adopted.

There is another municipal improvement effecting the public health closely allied to water purification; it is sewage disposal.

When a man red-handed from murder comes upon you and threatens your life and the life of your wife and children, what do you do? If he has destroyed a whole family, or got into a school anl killed your child and my grandchild, what do you want to do? We do not wish to allow him to raise a manhole cover or otherwise enter a sewer and escape to the river, whence he may return to commit other outrages, as recently occurred in Massachusetts, when certain convicts got out of the state's prison.

Yet to-day, in ninety-nine cities out of one hundred, the authorities are allowing to thus escape through the sewer, germs more deadly than the most bloodthirsty pirate that ever infested the seas. The bacillus typhosus and his kindred germs, like the convict, must not be allowed to reach the river. This red-handed fiend, the bacteria of zymotic diseases, gets into the sewer, but should never come out.

I know of only one sure way to kill him, once he is in the sewer; it is to run him, with all the foul fiends in his company, into the inferno of the septic tank. As the water, from which he is separated, passes out, let it go through the furnace of the oxidizing filter-bed, where all organic matter is consumed. In other words, build the sewer in such a way that all offensive matter is retained therein, and only purified water flows out.

The great bulk of domestic sewage is water which ultimately must be received into other bodies of water. If it escapes into salt water in an unpurified state, the lighter portions will float away to distant shores and lodge on the rocks and beach, putrefy, give forth offensive gases, and breed disease; while the solid matters will settle to the bottom and stay there, gradually filling up a dock, a channel, or a whole harbor, injuring navigation and commerce, and ruining the fishing and oyster industries. To pollute a harbor and make it offensive is a relic of barbarism and should not be tolerated in this country in the neighborhood of the model city.

The effect of sewage on fresh water is to poison it and render it unfit to support life of any kind, higher than that of sewer fungus. The drainage from two pulp mills entering Lake Champlain has killed many fish, tons of them recently having been cast upon the shore, and it has rendered a vast bulk of fresh water in that beautiful lake unsafe for domestic use. The dreaded germs of pollution and disease have been traced for hundreds of miles from the place where they entered the water. They are not like a mineral poison, gradually becoming diffused and harmful by dilution; but under certain conditions increase with great rapidity, a day sometimes multiplying one germ into fifty.

To purify sewage, to destroy all germ life of whatever character; that means the removal of all organic matter that can putrefy; it i necessary to pass it through a properly built septic tank and to effluent in a proper manner.

If, by the crude, sanitary methods of the back country, the infant's chance of life is increased, and the chance of reaching seventy years of age, the alloted span of life, is quadrupled, what may reasonably be expected in the model city of the future, where every citizen is protected in health as well as life, liberty and the pursuit of happiness.

Words fail me when I attempt the description of the model city of the near future, wherein the health conditions are as much improved compared with those of the country to-day, as are those of the country compared with those of a great city. The slaughter of the innocents will have ceased and not forty or twenty per cent. of mortality among the children will prevail. Old age will be the rule and not the exception. Those diseases which arise or spread from filth and pollution will be banished; and the homes of that city will be indeed blessed.

Such a city is no dream of Utopia, but may be built to-day by availing of the well known and demonstrated laws of sanitation.

President Rust: The paper is now open for discussion.

Mr. Sherrerd: The writer of the paper referred to certain conditions in Albany. Perhaps those were the conditions three or four years ago, but I don't think it is fair to allow the statement to go unchallenged, for since the introduction of the new water system no such conditions exist. I do not think the city officials now use spring water in their offices.

Mr. McClintock: I meant the state officials. I visited their offices last summer, and they were using the spring water then.

Mr. Adam: He lays great stress upon the longevity of the people in the country. There are other facts which make life in the country superior to that in the city that has nothing to do with engineering science. The people in the country live a more natural life than the people in the city. For one thing they haven't the smoke nuisance which we have in cities. I see you are troubled with it now in Indianapolis; but when I was here ten years ago the air was as clear as any place in the country.

Secretary Tillson: The constitution provides that in case of any amendment notice shall be given in writing on the first day of the meeting. I wish, therefore, to give notice of this amendment:

Amend Article 1, Section 1, by inserting in the third line, before the word "past" the words "three last."

MR. FOLWELL: I think it is well to mention that written discussions on papers will be received within two weeks of the date of the meeting, said discussions to be printed with the papers themselves. There are many members who have not come prepared to discuss these papers, yet they may have data at home that will be of great value to the discussion. I shall ask if it is the desire of the Society to permit this?

PRESIDENT RUST: I think the suggestion is a good one, and if a motion is made I shall put it to the convention.

MR. FOLWELL: I move that members be allowed to write out discussions of this paper and send it to the Secretary after the convention, and that it be part of the report.

MR. SHERRERD: This same question came up in a meeting of the American Waterworks Society, and it was decided there that these written discussions be submitted to the author of the paper. I move as an amendment to Mr. Folwell's motion, that the author of the paper under discussion be permitted to examine the written discussion before it is printed.

Mr. Sherrerd accepted the amendment as part of his motion.

MR. STEECE: I move that all written discussions be subject to the approval of the Secretary.

MR. FOLWELL: I shall agree to that also.

After some further discussion Mr. Ballard offered as a substitute for the motion and amendments that the written discussions be submitted to a committee of three, of which the Secretary should be chairman.

All the motions before the house were finally withdrawn, and the President appointed a committee of three to consider the be plan of handling the written discussions. The committee was c posed of Messrs. Sherrerd, Adam and M. Folwell.

The session was then adjourned.

SECOND SESSION.

The second session was called to order at 9:30 a. m. by President Rust.

President Rust: The first thing in order is the report of the Committee on Taxation and Assessment.

Mr. Ballard: I am afraid the report of the committee will amount to very little. The committee has nothing of special interest to report at this time. I might say it has been impossible under the circumstances to get the committee together so that a report could be made. I think one member of the committee is here, and he may have something to say that can be classified as a report. The geographical conditions were such that the committee could not have a meeting, so the chairman has nothing to report, except that he is prepared to read a paper and make a few suggestions.

On motion the report of Mr. Ballard was received, and he then read the following:

TAXATION.

The foundation of all municipal government rests more solidly upon what is known as Taxation, than upon any other part of the whole superstructure.

Individuals spend much of their time to devise ways to evade paying the amounts that they should honestly pay for taxes, both real and personal. I venture the assertion that a goodly number of so-called charitable Christians, who give liberally of their wealth to ameliorate suffering in this world, will be unwilling to answer the question when St. Peter shall meet them at the gates ajar—if they had ever in any way evaded or tried to evade the paying on earth of the full amount that they should have honestly paid in taxes, both real and personal.

The consideration of the subject of Taxation, whether in a general or circumscribed form, brings vividly and impressively to the mind that old head-line of our school days, "Many men of Many Minds," as unquestionably more thought has been expended upon the subject from every viewpoint by officials and laymen, than upon any other within the vast range of economic questions incident to government and its support whether national, state or municipal. It is my purpose to as succinctly as possible place before you my thoughts bearing upon the subject garnered during my official life.

Taxation in the public laws of the State of New Jersey signifies the system of raising money for the public purposes. Authorities of world-wide repute differ as to the definition of taxation, in fact, the old theory that taxes are payments for protection, has been attacked with severity by modern authors, and by many utterly repudiated as a pure fiction without foundation. Prof. Ely in his work on taxation in American states and cities, gives the following definition, which seems to have met with the largest approval: "Taxes are simply one-sided transfers of economic goods or services demanded of citizens, and occasionally of those not citizens, but who, nevertheless, are within the reach of the taxing power, by the constituted authorities of the land, for meeting the expenses of government, or for some other purpose, with the intention that a common burden shall be maintained by common contributions or sacrifices."

Many officials charged with the imposition and collection of taxes are of opinion that the words taxes and assessments are synonymous terms. I hold that in law and practice such is not the fact. Taxes are, and of right should be, a burden imposed upon all persons and property alike, upon some well established principle of equality and uniformity. In the State of New Jersey so universal was this contention that the framers embodied it in the constitution of the state in the following language: "Property shall be assessed for taxes under general laws and by uniform rules according to its true value."

Assessments are not burdens at all in the sense that taxes are. They are merely benefits or equivalents and are generally imposed on property benefitted only.

New Jersey is not alone in requiring that "property shall be assessed for taxes under general laws and by uniform rules according to its true value," as the same language or its equivalent appears in the fundamental laws of many of the states. So that it would seem that no matter what methods or systems are in operation in the several political subdivisions of the Nation—the underlying thought seems to be that wherever the imposition of taxes is a necessity, the method of levying the tax should be such as would seek to serve all alike, and yet I venture to say, that should a fair unbiased but searching examination of the laws enacted by the law-making power of the several states, covering the methods under and through which values for taxation are determined and exemptions permitted be made, it would disclose conditions under which nearly one-third of the actual value of all the tangible and intangible personal property escapes taxation. The value of real property is determined by such loose, ignorant and unbusiness-like methods that nearly as large an amou of actual values are exempted and consequently lost to the taxing au ities; nor is this all, the examinations referred to will disclose tha loss is sustained through the acts of legislators, who through charity or fear, or both, have enacted laws, the operation of which permits the wholesale exemption of the following classes of property: The real and personal property controlled by religious, quasi-public and so-called benificient agencies or organization; the holders of national, state and municipal securities; the swearing off of indebtedness even against realty; property owned by soldiers and sailors, firemen and policemen, and even members of the National Guard, to which must be added the exceptions more prevalent at this time than ever before in our national history, those that result from the enactment of discriminating laws, that are being considered at every meeting of the law-making powers of nation and state. through the insistence of agents of the vast aggregations of capital commonly known as trusts.

If present conditions are such as I have stated, it seems to me that no more important subject can be discussed. Permit me to say that in my opinion a change will never come until men of courage in every department of government will by united effort cause the repeal of such laws as permit what in a general way I have set forth, and in their stead, enact such laws as were intended by those who placed in the constitution of many of our states the provision hereinbefore quoted, through which it was evidently intended that all property should pay taxes, no exemption should be permitted. So far as real estate is concerned, I believe the rules should be: First assess the land, so that proper equalization could be determined, and after that is done the betterments should be considered, under uniform rules according to their true value. As to personal property I believe that all personal property, whether tangible or intangible, should be taxed. And in order that fraud in returning such property for taxation be minimized, I would make every holder his own assessor, and enact laws, such as are in force in some parts of Europe, to-wit:

That the settlement of all estates be vested in the control of the taxing authorities, and if in the settlement of the estates of deceased tax-payers, it is found that false returns were made, that the estate shall be liable.

In conclusion, permit me to express the belief that should laws be enacted that would carry out the scheme of taxation above stated in a general way, every real need would be met, and the burden of the individual be lessened.

MR. REIMER: I should like to know what Mr. Ballard means by "intangible personal pronerty?"

MR. BALLARD: Everything in sight and everything out of sight.

CHARLES CARROLL BROWN

Consulting Engineer, Indianapolis, Ind.

Second Vice-President, American Society of Municipal Improvements.

PRESIDENT RUST: Professor Burrage, of Purdue University, is present and has a paper. As he wishes to leave the city this morning we had better hear his paper now.

Professor Severance Burrage, of Purdue University, Lafayette Indiana, read the following paper:

SANITATION OF INDUSTRIAL AND PUBLIC BUILDINGS.

Sanitation, or sanitary science, or practical hygiene may all be termed preventive medicine. They have to deal with preventable diseases on a large scale; that is, they do not deal with the health of the individual. The preventable diseases are mostly germ diseases, caused by micro-organisms that we call microbes or bacteria. A large proportion of the so-called preventable diseases are due to some kind of germ. If we study a vital statistics table we will find that only about four per cent. of the deaths are due to old age. The other 96 per cent. are due to some abnormal condition of the body which we call disease. A large majority of these deaths from some form of disease might have been prevented had the proper sanitary precautions been observed.

Sanitation attempts the prevention of germs diseases in two ways. First, by the removal of the germ from the environment, and second, the removal of the conditions which render people susceptible to these germ diseases. General sanitation deals with both of these methods; and the sanition of buildings deals with both of these methods. Take, for example, the sanitation of buildings under the first method, the removal of the germs. Here we have to deal with the cleanliness of the building, the methods of sweeping and washing the floors, the washing and distribution of towels to the toilet rooms, etc. And sanitation of buildings under the second method, that is, attempting to keep the bodies of the people non-susceptible to the germ diseases, by ordinary hygienic precautions, proper ventilation, heating, lighting, plumbing, drainage, sewerage, water supply and in fact everything which pertains to the comfort and health of the inhabitants of the building.

I have made a classification of public and industrial buildings, as follows: Public buildings include hotels, theatres, railroad stations and some stores; schools, town and city halls, various public institutions as hospitals, asylums, and prisons. Industrial buildings include factories, sweat shops, and certain stores in which there is some manufacturing or repairing going on.

First, let us consider the public buildings. The first group of public buildings which includes hotels, theatres and railroad stations in our larger cities particularly, are fairly good examples of buildings in which the sanitation has been well looked after. The reason for this is evident. They seek patronage, and the cleanest, best regulated, best ventilated, most comfortable in every respect hotel or theatre will have the largest patronage. On the other hand, when we come to the schools and town and city halls, buildings which are put up as a rule with public money, in many cases little or no attention is given to the sanitation of these buildings. This is also true of many asylums, prisons and other institutions. It takes a crusade on the part of the general public after some particularly bad building is discovered before any improvement can be made. It is very rare that one can enter the toilet rooms of any of these last mentioned public buildings without noticing a distinct disagreeable and usually unhealthful odor. This may be due to bad plumbing or bad sewerage, but in nine cases out of ten it is due simply to a lack of general cleanliness. The ventilation, heating and lighting of these buildings is rarely properly looked after at the time the building is built, and it is evident that nothing satisfactory along these lines can be done to an old building.

Let us turn to a consideration of the so-called industrial buildings, including factories, sweat shops, etc. Here we have buildings put up by companies whose sole object is making money, with the least expenditure of money on their part. In a large proportion of cases absolutely no attention is given to sanitation in manufacturing buildings. It is only within the last few years that some corporations have begun to realize that by the expenditure of some money for the comfort and the preservation of the health of their employes, they can get more and better work out of them, and the money which has been spent in this way is well spent. Some notable examples of corporations who have realized the benefits to be derived from this care of their employes are the Pennsylvania Railroad, the Elgin Watch Co., Elgin, Ill.; the National Cash Register Co., Dayton, Ohio, and the McCormick Harvesting Machine Co., in Chicago. These are by no means all, but they happen to be the ones with which the writer is most familiar. In some states there are certain laws in regard to the construction, ventilation, lighting of factories and manufacturing buildings. In such cases the manufacturers are forced by the law to do certain things. They do not do it from the standpoint of philanthropy; they do not do it from the standpoint of economy, but these corporations mentioned above, with many others, have taken the matter up because they believe it is money in their pockets to do so. Some of them have admitted to me frankly that they would not spend money for sanitary improvements if they did not feel that it would come back to them indirectly, because their employes would be more healthy, more comfortable and satisfied, which means a great deal nowadays to the manufacturer. In certain recent strikes, some of the complaints made by the strikers were in regard to insufficient toilet room facilities. In other cases complaints have been made relative to the water supply, the employes being forced to drink water which was known to be contaminated and unsafe to drink. It is a sign of advance from the sanitary standpoint at any rate that some of these large corporations are employing sanitary engineers for the sole purpose of looking after the sanitary conditions of the factories and surroundings, and to care for the health of the employes. The writer was employed for three months the past summer as consulting engineer for the McCormick Harvesting Machine Co., in Chicago, and while giving attention to all matters pertaining to health of the employes, he gave particular attention to the water supply. The water which had been supplied to the employes was largely city water, which was acknowledged to be unsafe to drink a greater part of the time. A temporary arrangement was made by which the employes were provided with artesian well water during the hot months, and recommendations were made which provided for the supply of artesian well water all over the works all the time. The various factories connected with the above mentioned plant as a rule were not very bad from the sanitary standpoint, and yet they were far from perfect, and it is the intention of the authorities there to make improvements in the conditions as rapidly as possible.

From the fact that there are so many public and industrial buildings distributed throughout cities that do not fulfill the requirements of sanitary science, it would seem to me advisable that the cities should have a sanitary inspector of buildings just as they have to-day a plumbing inspector, medical inspectors of school children, factory inspectors, etc. The duties of the sanitary inspector, if the office were filled by one man, which in large cities would not be feasible, should be to look after the general sanitary conditions of the buildings, cleanliness of the toilet rooms, cleanliness of the floors, and any other factors which would pertain to the health of the inhabitants of the buildings. It might be well for the sanitary inspector's office to have several deputies, one for school buildings, one for railroad stations, one for hotels, one for factories, etc. In this way great improvement would undoubtedly result, provided, of course, that the duties of the sanitary inspector could be covered by city ordinances. There should be issued from the sanitary inspector's office, just as there is from the plumbing inspector's office a list of plumbing regulations, a list of sanitary regulations covering the cleanliness and healthfulness of the various classes of buildings. It is not the object of the writer to further complicate the already too much complicated machinery of city governments, but he feels that a vast amount of good could be accomplished, particularly in the schools, public institutions and factories, if there should be a regular systematic sanitary inspection of the public and industrial buildings.

President Rust: The paper is open for discussion. I think we are greatly indebted to Professor Burrage for his excellent paper.

Mr. Adam: Professor Burrage spoke about the inspection of buildings by city officials. I think that is done by the Boards of Health in many cities. In Newark the Board of Health has supervision of all this work. I presume the same is true of Indianapolis and other cities.

Proffessor Burrage: I think it is true in some cases, but it depends too much upon the efficiency of the Board of Health as to the extent that is done.

Mr. Adam: In Newark they have a code which they follow out. I think all these matters are defined in the regulations. The health officers are expected to go out every day and see that those rules and regulations are carried out.

President Rust: The next committee to report is the Committee on Disposal of Garbage and Street Cleaning. The report is to be made by the chairman, Mr. John Jones, Street Commissioner of Toronto.

REPORT OF COMMITTEE ON DISPOSAL OF GARBAGE AND STREET CLEANING.

Mr. President and Gentlemen: Before presenting what can hardly be dignified with the title of a report, being merely a few general observations by your committee, I wish permission to make a short explanation of my appearance before you as chairman of this committee.

A few weeks ago only I was informed by our worthy President that Mr. Emigh, the regularly appointed chairman, had unfortunately been compelled to resign the position, and that I had been appointed in his stead. There was but little time left to prepare a program, and my efforts in that direction, I am sorry to say, have not met with much success. I communicated with a large number of the cities and towns represented here, and belonging to the Society, with a view of securing some form of contribution to a discussion on the subject in question, but only a very few even acknowledged receipt of my letters. In this connection I desire to remind the meeting of a motion, or perhaps it was only a suggestion, adopted at the convention held three years ago, I think, viz.: that the Secretary should secure the names of the leading officials in charge of municipal works in the various cities and towns, and furnish a list of the same to every chairman of a standing committee, early in the year, whereby the latter would be enabled to communicate direct with the head of the particular department in which his committee was interested. I am not aware that this has ever been put into effect. It would be of great help, and produce much better results, I am sure, than the present haphazard method of addressing communications to the mayor or city engineer or other general officials.

In offering an apology for the lack of a formal report to present on this occasion, your committee are of the opinion that the subjects of garbage collection and disposition, and street cleaning, have been so exhaustively dealt with at former conventions of this Society, that there is little which is absolutely new to be said. Doubtless this fact weighs largely with those who are asked to prepare papers or otherwise contribute to the discussion. There appears to be a prevailing impression that unless one has something original to present, it is better not to say anything. Your committee think this is a mistake. It is obvious that of the various matters of municipal import which comes before this Society for discussion, some are not as manysided as others, although they may be of equal or greater importance from the standpoint of public heath and well-being, than the latter. The disposal of garbage and the proper cleaning of streets are works in which every citizen has a direct individual interest, and it follows therefore that this Society, which exists for the sole object of promoting knowledge on matters of a municipal character, cannot allow the subjects in question to be relegated to the background, or the discussion thereon to degenerate into a mere formality. Your committee are quite well aware that it is not easy to suggest a remedy for keeping up a live interest in these topics. We think, however, that where it is not practicable, or convenient to prepare an exhaustive paper, on technical lines, a short statement of the changes and improvements in the performance of the works might be submitted by the representatives of municipalities where such have been adopted. There are nearly one hundred of the principal cities and towns of this continent represented here, practically all of them progressive, and it is hardly to be supposed that a number of them at least do not adopt new methods and new machinery each year for the more effective and economical performance of the scavengering and street cleaning services. If information along those lines was submitted at each successive convention, the members would gain by the experience of others, and could apply the knowledge in their own work, or bring it to the attention of those in charge of the departments in their own cities. It must not be forgotten that, generally speaking, the men who control the works now under discussion, have no professional standing, but are assumed to possess good sound sense and judgment. While it might not be convenient with the majority of them to prepare an exhaustive or highly technical paper on the subjects, it would be no hardship to submit a brief statement of any improvements they might adopt from time to time, by which means others engaged in the same work would get the benefit.

All of which is respectfully submitted.

JOHN JONES,
Chairman.

Mr. Jones followed his report with a paper on "Toronto Garbage Destructor."

BRIEF DESCRIPTION OF NEW GARBAGE DESTRUCTOR AT TORONTO, CANADA.

One of the most serious problems which every city and town of any considerable size has to contend with is the proper disposal of its waste materials classed under the general term of garbage. There are various methods employed but at present I am only concerned with one, namely, incineration, which is the method adopted in my own city.

Toronto's experience with garbage destructors began in the year 1891. They were patterned after the Mann system; some changes of his own being made by the late Mr. Emerson Coatsworth, former city commissioner, under whose supervision they were erected, one in the east, and one in the west end of the city. A couple of years ago the destructors were placed under my department, and it was decided to thoroughly remodel the one in the west end. Prior to the time I am speaking of, I had made a somewhat close study of the incinerating system, having had occasion to visit a number of cities where this system was in operation, for the purpose of examining the various kinds of destructors in use. I noted the good points of each, and my conclusion was that a destructor could be designed which, while different from any I had seen, would combine the distinguished advantages possessed by those of different make. Briefly stated, our new destructor is a combination of the Mann, the Thackeray and the Dixon sytems. As I have already mentioned, our former destructors were built after the Mann pattern. The furnace was 30 feet long by 10 feet wide, and about 7 feet high. The materials to be consumed were dumped through holes at the top direct onto the fire. At the time of its construction, this destructor was considered one of the best in operation, and answered its purpose very well. There was no stench or nuisance of any kind attending its operation, and the process of incineration was thorough, but at a great cost for fuel. Its chief drawback consisted in the fact that the refuse was dumped direct on to the burning grates, consequently, every fresh charge almost extinguished the fire. As garbage usually contains a large amount of moisture, it took some time for the fire to recover, which meant just that much delay in disposing of each charge. Furthermore, the sudden contraction caused by this moisture had a tendency to loosen the bricks in the crown of the furnace, and they were constantly falling out. The Thackeray system, operated in Montreal, is similar to the Mann, except that it is built in chambers, or cells, each about 16x10 feet. It has, however, the same drawback mentioned in connection with the Mann, namely, the wet materials are dumped direct upon the fire.

The Dixon furnace of Toledo is doubtless well known to most of the members present, and I need not go into any lengthy description of it. It is constructed either of brick or with a steel jacket lined with fire-brick, and is usually built about 6 feet wide and of any length required. Its principal feature is a system of upper carrying bars made of fire-clay on which the garbage is dried when first dumped into the furnace. I saw one of these destructors in operation at Fort Wayne, and considered it to be the best system I had so far observed. As I have already stated, our new destructor combines the best features of the three systems just referred to, namely, the Mann, Thackeray and Dixon, and I think I may safely assert that it is second to none on the continent for the effective disposal of all manner of waste materials, at a comparatively small cost for fuel, etc. With your permission I will briefly describe its construction, which you will perhaps follow more readily with the assistance of the lithographed copies of the plans I have had prepared, somewhat hurriedly.

The measurements of the furnace over all are, length, 35 feet 4 inches; width, 14 feet 6 inches; height, 12 feet 6 inches. The chamber is built of brick work two feet thick; having 4½ inches of fire-brick; 2-inch air space, and the remainder red brick.

Figure 1, shows a side elevation of the furnace; the method of bracing; the poking holes, ash-pit doors and air openings, each 6x2 inches.

Figure 2, is a longitudinal section, showing interior of furnace; ash-pits; fire and poking holes; and section of main fire bars; also section of the upper fire-clay carrying bars; and feeding holes in the crown. The crown is built of 9 inches of fire-brick and 2 inches of fire-clay pug; the remainder being red brick. In shape inside is a segment of a circle. At the back of the furnace is shown over the upper grates, a small opening through which evaporation from the garbage when in the drying chamber is carried along with the draft from the burning chamber, into the flue or duct leading to the chimney. The flue is provided with a circular damper to increase or reduce the draft at will. The waste heat passing through the opening just referred to is sufficient to destroy all gases and effluvia generated in the upper or drying chamber. Fronting this opening is a hood formed of three upper carrying bars. At the firing end, the carrying bars are clustered for a distance of 2 feet 3 inches, forming a hood, so that the garbage is carried that distance from the coal fire, preventing the fire being smothered while the materials are drying or feeding. The roof of this cluster is sloped so that nothing will lodge thereon.

Figure 3, is a half plan and shows a section of the furnace at the iron grating, or main fire bars; with the fire-brick lining of the poking holes; and air space; and section above the ash-pit. At the front end of this view is shown the shaking grate of the coal fire grate, and the first ash-pit. At the flue end, it will be noticed that the center wall, which carries the upper fire-clay bars, is run through the flue, but at a vanishing point.

Figure 4, is a half plan, and shows ash-pit and cleaning holes.

Figure 5, is a half plan, and shows feeding holes at the top of the furnace.

Figure 6, is a half plan section showing the upper carrying bars of fire-clay; and the air duct from this part of the furnace to the flue, shown in figure 2.

Figure 7, is a transverse section looking through the center of the furnace to the back. This shows the poking holes; fire grates; and upper carrying bars of fire-clay resting on main center wall of the evaporating chamber connecting with main flue; also feeding holes from the top.

Figure 8, is also a transverse section of the furnace, looking towards the front, showing the inside of the fire chamber, also walls, fire-bricks and air spaces.

Figure 9, is a rear end elevation of the furnace, showing its method of buckstays; and construction of the flue into main duct.

Figure 10, is a front elevation, showing buckstays; and coal fire, and ash-pit doors, two of each, which are set in a front iron plate.

Capacity. The inside measurements of the furnace are, length, 29 feet 4 inches; width, 10 feet 6 inches; height, 7 feet 7 inches. In a day of 24 hours it will consume from 75 to 80 cart loads, of an average weight each of 1,500 pounds, or a total of 60 tons of garbage and refuse materials of all kinds. Night-soil we do not cremate; its handling and disposal being done by private contractors. I may mention that the quality of the refuse collected in our city varies somewhat according to the season of the year. Our average collections contain about 30 per cent. of garbage proper, that

is, kitchen waste consisting of animal and vegetable matter; the balance being manufacturers' waste and household rubbish. In the summer season the waste from factories, stores and such like provides the necessary fuel for operating the furnace, and very little coal is required. During the fruit season and in winter, when the collections contain more or less moisture, about a half ton of slack is required to operate the furnace 24 hours; that is, half ton of slack to consume 60 tons of refuse.

The residue from the materials consumed averages about 7 cubic yards every 24 hours. It is of little or no commercial value.

Maintenance. **Assuming that we burn half ton of slack per day, the cost of fuel (at $3.00 per ton) would be........................$ 1.50**

Labor, six men at $1.80 each per day............................ 10.80

Total per day of 24 hours...............................$12.30

Representing a cost of 20 cents for every ton of refuse consumed.

Cost of Construction. **The furnace was built by day labor. All the fire-bricks and fire-clay were supplied by the Harbison-Walker Co., of Pittsburg, the freight on which was, of course, considerable. The total cost of the furnace was $5,000. It could be, I think, built in the United States for less, as there would be, probably, a smaller charge for freight.**

The chief advantages I claim for this furnace are:

1. ***Cheapness of construction.***
2. ***Effectiveness in rapid and thorough combustion.***
3. ***Entire absence of odor or nuisance of any kind.***
4. ***Economy in operation.***

JOHN JONES,
Street Commissioner, Toronto, Canada.

MR. HAMILTON: Could any apparatus be introduced into the incinerator that would utilize the heat for generating steam?

MR. JONES: I have given that matter consideration, and I see no reason why it could not be done by simply running a coil of pipes around the outer part of the walls. Or you could run them inside, and by doing this could generate steam enough to run a great plant. If you have sufficient garbage to keep your oven up to a proper heat and put in the proper coils, there is no reason why you could not generate enough heat to run a great plant. There is, I think, a company formed in Minneapolis, and another is being formed in New York, to utilize a patent invented by DeCory. He uses entirely for his upper carrying bars a water pipe in the shape of an inverted V. It is covered by a patent, however, and he is so unreasonable about it when I looked into the matter that I had to get something else for the work I wanted done. I don't think there is any reason why a plant could not be run by putting coils in the burning chamber as well as on the outside walls.

MR. HATTON, Wilmington. Del.: I was interested in Mr. Jones's report as chairman of the committee, and particularly interested in one particular phase of it, and that is the securing of data for the information of the various cities and smaller towns in the United States about garbage disposal and garbage collection. I have looked that matter up for the last eight or ten years, and I find there is an utter lack of competent knowledge on the subject. I have written to several city officials, probably fifty, and have visited a large number of them, and have found that they have no data which is at all valuable to the men seeking for information along this line. There is no reason in the world why they could not get that data, and in Mr. Jones's paper upon the process in use in Toronto I find he has left out the very data we are all after. We all want to know how much it costs per ton to collect and dispose of the garbage, how much garbage per inhabitant you are expected to collect, and how much it costs to get rid of the refuse or residue of the garbage after the burning. All these matters are of vital interest, not only to the larger cities but to the smaller towns. It seems to me the committee as now constituted could do a very excellent work in the coming year by collecting this data very carefully and presenting it to us at the next annual meeting, so that it can be printed in our proceedings. I take it that it would be of great value. Last week I attended the meeting of the American League in Baltimore, and we were taken down the bay to see the new process in use by that city. The Street Commissioner went down with us and attempted to tell us all about it; but, as a matter of fact, none of us were able to get the information I have just spoken of. I suggest that the committee be continued, with the idea of collecting this data for the use of the members, and that it be presented at our next meeting and printed in the proceedings of the Society.

President Rust: I think your idea is a very good one, and we shall act upon it.

Mr. Adam: He speaks of a lack of knowledge of the cost of collecting and disposing of garbage. Two years ago the City of Newark adopted a sanitary measure for disposing of its garbage. It had disposed of it in the same manner as nearly all the larger cities had been doing, collecting it and dumping it upon the neighboring low lands of the City of Newark. In this case the plat upon which it was dumped contained about four thousand acres. This method was not deleterious except in the hot summer months. I took the matter up, although it was not in my sphere, made research, collected a number of city reports to give me the necessary data, and presented this to the Board of Works to give them some idea of what they could do to dispose of the garbage in a sanitary way. For the information of Mr. Hatton I shall refer to a book published by Col. Waring, deceased, Engineer of the Street Cleaning Department of the City of New York. That will give Mr. Hatton much of the information he seeks. I have also taken the reports of the City of Toronto, and have found that they give much of the information Mr. Hatton seeks. It shows that Toronto collects its garbage as economically as any city I know of. The City of Newark was at a loss to say how much garbage was collected and would have to be disposed of. I based my calculations on the collection of the City of New York per inhabitant, and on that basis figured out what it would cost the City of Newark to collect the garbage for five or ten years, allowing for the increase of the population according to the census reports. If you can secure one of those books published by Col. Waring you will have one of the most thorough works on the subject published.

Mr. Benzenberg, Milwaukee, Wis.: If any number of cities in this country keep a regular record of the amount of material handled, or keep a record of the cost in detail, few of them are anxious to make this information public, because it would not reflect credit upon the city or the department. If, however, the committee will formulate a number of questions, the answers to

W. B. HOWE

City Engineer, Concord, N. H.
Third Vice-President, American Society of Municipal Improvements.

which would give the desired information, I believe in many instances the heads of the departments would be led to a new train of thought and would make a new effort to secure sufficient information to answer the questions. Perhaps they would do this more willingly if they were promised in return a compilation of all the answers received by the committee. There is much being done in the way of improving the methods of disposing of garbage and offal. The methods in use in various cities undoubtedly depend upon how the garbage, offal and street cleanings are collected. In many cities the street sweepings are disposed of by a department entirely separate from that which controls the collection of garbage. In such cities naturally the tendency would be to dispose of garbage by itself, independent of factory refuse and street cleanings. Cities that dispose of garbage in that way naturally resort to some reduction plant instead of an incinerating plant, because of the garbage not containing any fuel quantity which would aid in the incinerating process.

In visiting various cities and making inquiries regarding the methods of disposal I have had some opportunity to give some attention, and in fact have made some test of a modified process of reduction, which perhaps may be of some interest to the members of the Society. The process in general follows somewhat the old Mertz system. The material is collected and dumped into what is called a digester, a steel shell cone shaped at the bottom, with a steam jacket around it and a steam drum or cylinder running through the center. The material is heated, but not cooked, as we understand the term. The material is entirely disintegrated by the heat to which it is subjected by the steam in the jacket and in the central drum, which runs up to a pressure of about seventy pounds. It is kept from boiling, or ebulition, as you might call it, by maintaining an air pressure in the digester on the material about fifteen pounds greater than the steam pressure. The result is that the entire material is disintegrated. The grease is not emulsified with the water and liquid contained in the garbage. After it has been thoroughly disintegrated the material is dumped into a drier and the process is continued about the same as in the Mertz system, the oil being extracted. The system of reduction is so thorough and complete that nothing of value contained in the garbage or the dead animals, which are also treated in the same way in connection with the garbage, is lost, and the residue has considerable commercial value. On a test that was made the residue was found to contain about thirteen per cent. of grease and oil and sufficient ammonia and phosphate to pay for the treatment, and their entire cost of reduction, and leave a very handsome balance for the interest on the plant, maintenance and depreciation. The system has recently been thoroughly investigated by some English capitalists through English experts who have just contracted for the use of the system throughout European countries.

I think that the system, which is rather an improvement, is so complete that it will enable the company, after further trial, to form other companies which will offer to dispose of or reduce the garbage and dead animals free of cost, simply requiring the delivery of the garbage at the plant. In fact, I know the company now controlling this method has made such a proposition to the city in which they are located. The company has just closed contracts for such a plant at Toledo, and a few other cities in Ohio and Pennsylvania. I think if they succeed it will very greatly simplify the question of the disposal of garbage, offal and dead animals in such cities where this material is handled by separate departments, and is disposed of independent of the refuse from streets, especially if the cities may be able to dispose of the material by simply delivering it at the plants of such companies. The company is not only willing to take the garbage and the dead animals, but night soil as well, and, although it may sound a somewhat dubious statement, I can say they have succeeded in getting a commercial product out of that.

Mr. Jones: Is it the Edison process you are speaking of?

Mr. Benzenberg: It is.

Mr. Jones: They have made that offer to us. They say if we will deliver the animal and vegetable garbage collected for a certain number of years they will dispose of it for nothing. I am going to see the manager of the plant in Cleveland on my return trip.

Now, in reference to data. In Toronto we keep a record of everything that is collected. Every load of ashes separate, and every load of garbage and dead animals, we have a record of from day to day. I am prepared at any time to give you that information, and I think that twice during my nine years' membership in this association I have given an outline of our system in Toronto. Whether we have a better system than other cities I cannot say, but I cannot get that information from any city in the United States. I cannot get the number of loads they collect or the cost of disposing of each load. I cannot give you from memory the amount we collect, but my appropriation will be $80,000, and that will include everything, ashes, garbage, street sweepings. I think it costs us about 55 cents a cubic yard for collecting. I may not be exactly correct in that statement, but it is about that price. I have given you the cost now of incinerating, which is 20 cents a cubic yard. Adding that to the 55 cents, you have about 75 cents for collecting and disposing of it.

I might say further that I had taken out the cost per capita of street cleaning, the number of loads collected, etc., with fifty other cities in the United States about our population, and was astonished to find we were the lowest in the list.

MR. STEECE: I think the gentleman from Wilmington can get the information he wishes from Minneapolis or Chicago. They have crematories there. I should like to ask Mr. Jones what provision they make for drying?

MR. JONES: They have an upper carrying bar on which the garbage is dumped. The improvement I have made is that I have put burning grates below the carrying bars and an ash pit below that, so that I have an entire evaporating chamber.

MR. ADAM: In the City of Newark the work is done by contract. I suppose the work is done in this way in a great many cities, and for that reason it is impossible to get this information. The contractor usually tries to keep his own figures to himself for fear someone will see he is making a big profit on the work. I tried to have inserted in the contract that the department should have the right to weigh the wagons.

MR. SMITH, Elwood, Indiana: I was in Cleveland and saw the Edison plant work. I saw them put in about 6,300 pounds of garbage, the commercial value of which, when it was reduced, was seven dollars a ton. The only trouble we find is that the first cost is expensive. For our little town up there we cannot put in a plant for less than $35,000. If it were not for the expense we would adopt it immediately. A crematory is very expensive to keep in repair, while this process is not at all; it will last for years and years. I think it is the finest thing in the world. I think all large cities should have these plants.

MR. JONES: I don't think it would pay Toronto to get one. I have given the matter a great deal of study, and I will tell you my reason for making that statement. All our large hotels and restaurants, where they make a great deal of kitchen refuse, sell it to people living outside of the city limits who keep hogs. We do not get it with the other refuse of the city. We only get the garbage from small houses. If we were collecting all the garbage from large hotels and restaurants we might do it.

MR. SMITH, Elwood, Ind.: In Dayton, Ohio, they have an ordinance giving them full control of all the garbage. That is all they ask.

MR. BENZENBERG: The material I spoke of contained no dead animals. It was rather a poor quality of garbage. I suggested that the people of the city were of rather a thrifty nature and did not waste much. I was told that all that material was from domestic kitchens; that the refuse from hotels and restaurants was taken care of by other parties in consideration of a return of some kind or other. I was told that neither the city nor these parties could get it. But, notwithstanding that, the commercial value of the residue of this garbage was about the value mentioned.

MR. HATTON, Wilmington: Mr. Jones stated that his appropriation was $80,000 for collecting and disposing of the garbage. That was your statement, I think.

Mr. Jones: Yes, sir.

Mr. Hatton, Wilmington: In the City of Baltimore, where they use the Edison system. it costs $57,000 for collecting the garbage under a ten year contract, and they get from that garbage two per cent. of oils and two per cent. of ammonia from the residue after the oils are extracted. Now they are going to use that residue as a basis for phosphates. They get none of the hotel or restaurant garbage. Baltimore is a city of about 500,000 people. I think, however, it is a mistake to incinerate garbage rather than save everything that is of commercial value out of it by a reduction plant.

Mr. Briggs, Erie, Pa.: The experience of the City of Erie with the garbage question has been of a decidedly negative character, and generally unsatisfactorily, except to the collectors, who find it a lucrative business.

In 1892 the City Council passed an ordinance regulating the collection of garbage, and providing that the producers of garbage should keep the same in cans, in convenient places, and that the Mayor and Board of Health of the city should make a contract with one or more persons, as they saw fit, to collect and dispose of the garbage. The contractor was to be required to visit each place that produced garbage, one or more times a week, as might be directed by the Board of Health, and was allowed to charge and collect for such service, each month, from the producers, as follows: Twenty-five cents for dwelling; 50 cents for boarding house; $1.00 for hotel, grocery or other provision shop.

This ordinance further provided, aside from the ordinary penalties for violation, that "no person shall engage in the business of collecting or disposing of garbage, save only those who have a contract therefor," etc. This the courts decided was unconstitutional, as it tended to restrict trade and the rights of individuals.

Soon after the first contract was made it was noised about that there was "money in it," and within a year the contractor found he had many rivals whom he wished the city to drive out of business, on the strength of the above prohibitory clause, with the result as noted.

The City of Erie covers an area of six square miles, of which the garbage collectors cover about four-sevenths of the most thickly settled part. During recent years the collecting has been mostly in the hands of one person, who has wagons carrying tight bottom iron boxes with a hinged lid on each side. The collectors are only required to take table and kitchen refuse, commonly known as swill, and tin cans. The producers are not allowed to throw into the garbage cans any rags, paper, ashes, etc.

The wagon boxes are supposed to be cleaned daily, when in use, but they become very offensive in hot weather, and as the collecting is done in the day time these wagons mingle with the public and in the general traffic on the streets, causing a bitter disapproval of the system.

The garbage is carted to a farm one-half mile from the city limits, where it is sorted by hand; the vegetable matter is fed to hogs, and the parts containing fat are placed in a large crude wooden tank or vat, into which, when filled, steam is turned until the contents are thoroughly heated, when the grease rises to the top and is drawn off into barrels and sold to the soap factories, producing a revenue of about $150.00 per month. The refuse remaining in the vat is spread over the farm, and plowed under.

The annual profits to the contractor have been considerable—ranging from nine to twelve thousand dollars.

REPORT OF THE COMMITTEE ON SEWERAGE AND SANITATION.

This committee has nothing new to report to the Society in its branch of municipal improvement. Mr. Alvord had intended to make a brief presentation of the present status of sewage disposal in this country, but business in New England prevented both his presence and the preparation of a paper.

Good times have kept the members of this Society so busy, apparently, that none of them except the author of "The Model City," which was read yesterday, has found time to furnish this committee with a paper. One member added undue modesty to this general excuse, but did furnish me with a few facts which I will lay before the Society. He writes:

HARTFORD, CONN., Aug. 18, 1903.

"*Mr. A. Prescott Folwell, Easton, Pa.*

"DEAR SIR: I have your circular letter of the 18th. I have a report to make to the Society, as chairman of its Park Census Committee, which would be the only paper that I would present to the Association, and it is really along the only line of work in which I have any hopes of interesting them.

"Of the questions you asked; the extermination of mosquitoes is the only one that I have had any practical experience with during the last year or two. Our 'Ten Mile Woods' used to be so infested with mosquitoes as to be hardly inhabitable. We have drained all sink holes and other spots where water stands, and have used the refined kerosene as a spray on all spots where we find water standing during the warm weather. The result has been practically no mosquitoes. This method is the usual one applied in these cases and, therefore, contains no element of newness.

"Yours respectfully,
G. A. PARKER."

"*Mr. A. Prescott Folwell, Easton, Pa.*

"DEAR SIR: I have yours of the 21st inst., asking that I make a statement regarding my work in exterminating mosquitoes. It has been such a crude and simple method that it does not seem to me worth reportin, in fact I feel somewhat ashamed to think that I have done the work in such an unscientific way. Keney Park, which consists of over 600 acres, has about 200 acres of woodlands. Most of it was the bottom of a pre-historic lake which flooded the Connecticut valley from Middletown to Holyoke, something like 40 miles long to 20 miles wide. From some causes which I do not know, there was left through this territory a large number of what we commonly call sink-holes. Although the land is considerably porous, the sink-holes are made water-tight by silt deposits, and when we took land for a park there were over 100 of these sink-holes with more or less water in them with sometimes a growth of marsh and water plant. They were terrible breeding places for the mosquitoes, as the wind seldom moved the surface of the water. Most of these have been more or less drained although there still remain quite a number of places which act as breeding spots for the mosquitoes. The first summer that the land was taken it was certainly uncomfortable and almost impossible to stay in the woods on account of the swarms of mosquitoes. To prevent their breeding, ordinary kerosene was taken to the woods in pails and, to commence with, was thrown over the surface of the water from a small tin cup, but during the last two years we have used for applying it a sprayer used for spraying for the San Jose scale. The result has been satisfactory and but few mosquitoes breed in the woods and persons are very comfortable there.

"I have kept no data as to the quantity of kerosene necessary to do this work, or the number of square feet of water surface that a gallon or any definite measure of oil will cover. I simply know that it takes about two barrels a summer for this work.

"I cannot see how such a crude method can be of much interest to the Association, and I much prefer not to undertake to make a statement which I feel, if made, should give definite data. My only object in this was to get rid of the mosquitoes, and the kerosene has done that.

"Yours respectfully,
"G. A. PARKER."

I will respect the writer's modesty, which he has as little reason for possessing as any member present, and will not give his name; but I hope that Mr. Parker will give use some additional information on this subject in the discussion.

MR. FOLWELL: That is not much of a report, but it may furnish ideas to people who wish to abolish mosquitoes. I am sorry Mr. Parker is not here, because he might be able to give us more information on this subject. Since I was not able to obtain a paper from anyone else, I have stepped into the breech myself, and have written a paper on the Perviousness of Sewers, which I shall read after the discussion of the report.

On motion the report was received.

MR. BALLARD: Mr. Folwell alluded to the Newark mosquito. I suppose the situation in New Jersey is pretty well understood so far as it relates to mosquitoes. At one time two of our residents from different localities met and were discussing the question of mosquitoes. One man said to the other, "You ought to live where I do; there isn't a single mosquito there." The man from Newark replied, "Well, there isn't a single mosquito in Newark, they are all married and have large families."

Now as regards kerosene. In a spot not far from Newark the oil was liberally used, and, so far as I have been able to learn, the mosquitoes there got fat on it. I don't know what the experience of the rest of you is, but ours is that kerosene is absolutely ineffectual to destroy the mosquitoes; in fact, the mosquitoes seemed to be there in greater numbers than before, and seemed to grow fat on the treatment.

Mr. Pollock, Brooklyn: In the suburban sections of Brooklyn this year private enterprise tried to get rid of the mosquitoes. I think perhaps on account of its being a good year for mosquitoes and a poor year for humanity we were not successful. We spent considerable money but did not get good results.

Mr. Reimer: The question of mosquitoes always comes from Newark. They don't say they have any in Staten Island or Long Island; New Jersey has to take it all. I was much interested in the New Jersey experiment. I judge from the statement made that the ground which had been treated was ground through which there was no running water, or if near running water the pools themselves were practically stagnant. The experiment which was tried in South Orange was made on pools that invariably, when it rained, overflowed, and the oil was thus all carried away. I was very much interested in a little experience of our own, which I think is one on that line well worth studying. We had in our neighborhood for several weeks in the early spring almost a drouth. The end of May came following several weeks in which there had been very little rain. I had occasion to do some topographical work, and having the ground well laid out sent some of my party to finish up certain work. The ground was very dry. The men had occasion to drive some stake lines through a copse of weeds four to five feet high, and the mosquitoes drove them out. There was no pool there, no moisture, nothing but the weeds. I came to the conclusion that the mosquitoes had grown without water: that the dews falling on those weeds had furnished them with moisture enough to propagate. That being the case, we have something more than the low ground to look after.

Mr. Folwell then read the following paper:

PERVIOUSNESS OF SEWERS.

BY A. PRESCOTT FOLWELL.

Importance of the Question.

"The importance of tight joints in sewers is being brought home to engineers and others interested in the drainage and sanitation of cities more and more forcibly with the extension of the separate system of sewer-

GEORGE W. TILLSON

Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Secretary, American Society of Municipal Improvements.

age, the rapid additions to the number of sewage purification plants, and the increasing length of outfall sewers made necessary by the demand that sewage shall be put where it will cause the least possible offense. With the combined system of sewers, a considerable amount of infiltration is expected and, comparatively speaking, is of much less significance than in a separate system, owing to its small proportion to the carrying capacity of the sewer. But in a separate system the water of infiltration sometimes forms a large part of the full flow of the sewer; and while it has but little effect upon the necessary size of the laterals it may materially increase the required size of the main outfall, if not some of the of the trunk sewers. Still, even here the amount of infiltration is small in importance compared with what it is when the sewage is disposed of by any other method than discharging it untreated into a natural water course. The volume of the sewage is one of the most important elements in connection with the cost of construction and operating a sewage purification plant. A diluted sewage may be more easily purified than a concentrated one, but an increased volume of water means that more land will be required for either intermittant filtration or broad irrigation, while with chemical percipitation a greater tank capacity is necessary although an increase in the amount of chemicals or in the resultant sludge does not necessarily follow. Wherever in connection with sewage purfiication plants or other methods of disposal the sewage must be pumped, of course the addition of ground water to sewage is again a serious matter.

"Considering the importance of this question there is a regretable dearth of information in print as to the best forms of joints to exclude ground water, and as to the amount of leakage which actually occurs in sewers laid in wet grounds."

This Engineering News editorial of nine years ago is as appropriate to-day as then. There has been some slight addition to our knowledge of the perviousness of sewers, and some methods have been tried for decreasing this. That the problem still rises to confront the sewerage engineer, superintendent and contractor is illustrated by a recent federal court suit, involving more than $100,000, based upon the failure of a sewer contractor to confine the leakage of ground water into the sewer of an average rate of 5,000 gallons per day per mile of sewer. (See article by Hazlehurst in Engineering News, Aug. 27th, 1903.)

Assuming, as is shown later on to be the case in many systems, that the infiltration equals 50 to 100 per cent. or more of the sewage proper, this necessitates larger sewers and more ample facilities for treatment where this is necessary. The obections to the former are two—the additional cost, and the less favorable conditions of flow during dry seasons when sewage alone enters the conduits.

Since 8-inch pipe constitutes at least two-thirds of most separate systems, and much of this is larger than is called for by theory, consideration of cost does not effect fully half of the pipe in such a system. Considering the total amount of each size of pipe required for a city of regular shape, having 20,000 population, 500 to the mile of sewer, all sewers on minimum grade, and assuming the cost of pipe and of handling and jointing the same (the trenching would be changed but little on account of increased size) to be 30 per cent. of the list price, the additional cost due to providing for 100 gallons per capita of ground water would be about $4,000 to $5,000. Of course in individual cases the topography might cause this to be diminished by 50 per cent. or increased by 100 per cent. The disadvantages of sewers too large for the amount of sewage reaching them is too well realized to need discussion here.

While the increase in treatment facilities need not always be proportional to the increase in sewage caused by infiltration of ground water, it must generally be nearly so. In fine sand filters it has been found that the area required depends upon the quantity of water as much as upon the quantity of organic matter to be removed. The beds at Plainfield, N. J., and at Westboro, Mass., for instance, were rendered practically inoperative by large volumes of ground water entering the sewer. Contact beds, if filled and discharged at fixed intervals, must be of a size proportional to the total flow. It is becoming the general opinion that the cross section area of a septic tank should be largely if not wholly proportioned to the total volume of sewage, the chief necessity being the mechanical one of securing a velocity of flow low enough to permit precipitation of the suspended matter. The increase in cost of construction due to doubling the capacity of a filter or contact bed would probably be 75 per cent. to 90 per cent. in most cases; and of a septic tank, 50 per cent. to 75 per cent.

There are certain more or less important advantages connected with this infiltration. The most apparent perhaps is the drainage of the ground effected, which is generally admitted to be highly advantageous from sanitary and commercial points of view. But the same advantage can be obtained by underdrains without the disadvantages, except that of increased cost, the cost of underdrains being several times that of using the sewers as drains. The considerable dilution of the sewage would also tend to reduce the liability of deposits and to hasten somewhat the "natural" purification of the sewage, ordinarily effected by dilution. But if the sewage is to be treated it would tend to increase the amount of organic matter reaching the outlet of the plant, since the percentage of organic matter removed by a given process generally diminishes as the sewage becomes more dilute.

More important, however, than any of the above advantages or disadvantages is the probability that a sewer whose joints are at frequent intervals of weeks or months admitting large quantities of ground water will, during periods of low ground water, discharge sewage into the ground, polluting the ground water and causing all the evils recognized as resulting from this. (If the joints are well made, however, and the infiltration is due simply to the porosity of the cement, nowhere exceeding say 3,000 gallons per mile, it is probable that there will be little if any pollution of the ground water.) Also, if the joints be be left open at the top (but so protected as to prevent the entrance of dirt) but be tight everywhere else, this method of combining sewer and drain might not be open to this objection. But too much emphasis can not be laid on the desirability of making joints as tight as possible everywhere except at the top, and especially at the bottom, where the poorest jointing generally is found.

It would seem from the above that if the sewage is at present or at any future time to be treated too much care can not be taken to make the sewers tight, from a financial point of view. From the same point of view, if it is not desired to add to the cost to drain the ground, tight sewers are desirable. And the only condition under which, from any point of view, the utmost endeavor should not be made to have every joint tight is where the sewage discharges into a large body of salt or other unpotable water, and it is desired to drain the soil; and here the only part of the joint admitting ground water should be the top. So that even in this case a material or process for obtaining tight sewers is extremely desirable.

Amount of Infiltration.

About the only practicable method of measuring this seems to be to measure the flow in the sewer before any buildings have been connected to it, or at the two ends of a stretch in which there are no such connections; or to measure it in a storm sewer of the separate system when no surface water is entering. Estimates, however, have been made by comparing the relative water consumption and the sewage flow in wet and dry seasons.

The amount measured or estimated has been expressed in terms of miles of sewer, area draining thereto, and population served. No statements, to the writer's knowledge take into account the size of the sewer, and few mention it even incidentally; and yet it seems probable that the amount of leakage is to a considerable degree controlled by the area of joints in pipe or brick work, through which most or all of the water enters, except in those cases where all of the ground water reaching the outside of the sewer finds its way into it.

The following measurements have come to the author's notice; and while others have probably been given in municipal reports of various cities he has not seen them, but hopes that in the discussion of this paper these will be mentioned.

In East Orange, N. J., in 25 miles of pipe sewer 8 to 24 inches diameter (about 21 miles being 8 inch) the leakage averaged about 8,650 gallons per mile per day. It appears from the description that perhaps 5 miles of this was in wet ground, and if all the leakage was in this length this would give about 43,250 gallons per mile per day. In two stretches of brick sewer built in wet ground—one as a tunnel lining—4,000 feet in combined length, about 5 gallons per second infiltrated, or at the rate of 570,000 gallons per mile per day, or 13½ gallons per square foot of interior surface of submerged brickwork. (Trans. Am. Soc. C. E., August, 1891.)

In Schenectady, N. Y., 60,000 gallons per day seeped into 15 miles of sewer before any houses were connected. How much of this sewer was in wet ground was not stated, but this gives an average of 4,000 gallons per mile.

Mr. Howard Carson, Consulting Engineer to the State Board of Health, in 1889 estimated from extensive measurements of Boston's "Main Drainage System" that the leakage into the sewers and drainage of cellars and low lands was 45 gallons per capita. He also estimates, from Mr. Gray's report of 1884, that in Providence, R. I., the infiltration was about 47 gallons per capita. Mr. Goodnough, Chief Engineer Massachusetts State Board of Health, in 1900 reported that "Records of the flow in sewers recently constructed, aggregating about 137 miles in length and ranging in size from 8 inches to 36 inches, show that the average leakage into these sewers before any connections were made with them amounted to 40,000 gallons per mile of sewer. Some of these measurements were made in the spring, at the time when the leakage is greatest, but others were made in the drier portion of the year. When connections are made with thse sewers it is likely that the leakage will be greater, on account of the larger number of joints.

"Records of flow of sewage at all times of the day and night in about 700 miles of sewers of various sizes in cities and town of Massachusetts indicates that the leakage in a large system would probably amount frequently to nearly 70,000 gallons per day per mile of sewer, and at times when the leakage is extraordinary to as much as 80,000 gallons per mile. As to per capita leakage, in those communities where the land is now nearly all occupied and where portions of the area are densely populated it is found that the average population per mile of sewer is about 800. So far as can be judged at present, this ratio appears to be a reasonable one to use, and upon this assumption the leakage into the sewers would be 100 gallons per inhabitant."

In Kalamazoo, Mich., the mains were carrying about 20 per cent. of their capacity "before the sewers were open for public use."

In Norfolk, Va., in 1888, "ground water formed at least 60 per cent. of pumping," or about 100 gallons per capita. (Sewerage of the Mystic and Charles River Valleys, 1890.)

At New Orleans the infiltration was found to be about .003 cubic foot per second per acre, or 31,800 gallons per mile of sewer per day. At Washington, D. C., in 1899, after an extremely wet season, the infiltration from 688¾ acres was found to be about .0015 cubic foot per second per acre.

At Malden, Mass., 38 miles of new sewer laid with underdrains, 60 per cent. of this in saturated soil, showed an infiltration of 50,000 gallons per mile of sewer, or 65 gallons per capita; or 83,000 gallons per mile of sewer in saturated soil.

In a city whose name was not given 8,140 feet of 48-inch brick sewer totally submerged by ground water, 2,500 feet with ground water 48 to 18 inches above the invert, 1,070 feet of 3 feet by 4 feet brick sewer with water 18 inches to 1 inch above invert, 6,800 feet of 2 feet by 3 feet entirely out of water—these combined had an infiltration of 1,800,000 gallons per day, or about 800,000 gallons per day per mile of sewer at all below ground water; or about 14 gallons per day per square foot of interior surface of submerged brickwork. (Eng. News, July 1, 1897.) A concrete sewer lined with 21-inch earthenware pipe laid in a tunnel through gravel and running sand, in England, admitted ground water at the rate of 140,000 gallons per mile. (Eng. News, December 31, 1890.)

At Champaign, Ill., in 24 miles of sewer in 1899 the infiltration was "several times" 300,000 gallons per day. If 720,000 gallons, this would equal 30,000 gallons per mile of sewer.

In Westboro, Mass., in 1899, an infiltration of 489,000 gallons per day in 1,950 feet of 15-inch vitrified pipe was found; or a rate of 1,320,300 gallons per mile per day; and in another stretch of 1,060 feet, 122,000 gallons, or 610,000 gallons per mile per day. (Massachusetts State Board of Health Report, 1899.)

An extreme case was that of a New York City sewer in which the 24-inch outlet to about five miles of 8-inch to 24-inch sewer in gravel soil full of water was running full and the water standing several feet above the top of the sewer in the manholes before any houses were connected, the fact that there was a 6-inch subdrain evidently being of little importance; this giving a calculated approximate flow of more than 1,300,000 gallons per mile per day. Several cracked and broken pipes were found on investigation, but these accounted for only a small part of the leakage.

Three thousand feet of 24-inch salt glazed pipe used as a water conduit for the Peoria Water Co., joints made with special care, gave a leakage outward of about 100,000 gallons per mile per day.

These are all the recorded data which have come to the author's knowledge, but he hopes that a discussion will bring forth others.

The above may be tabulated as follows:

CITY	SEWER		INFILTRATION, GALLONS PER DAY		
	CHARACTER	SIZE, ETC.	Per Mile of Sewer	Per Acre	Per Capita
East Orange, N. J..	Vitrified clay	10 to 24 inch; wet soil	43,250		
Schnectady, N. Y..	" "	Total system...	4,000		
Champaign, Ill....	" "	From 8 in. up; entire system	30,000 ±		
Westboro, Mass...	" "	15 inch; wet soil; two sections.......	1,320,300 610,000		
.............N. Y.	" "	8 to 24 inch; wet soil......	1,300,000+		
Malden, Mass......	" "	Underdrained; wet soil	83,000	......	110
Boston, Mass., Main	" "	8 to 36 inch; total systems..	40,000		
Drainage	....	Total systems..	....	......	45
Sever'l Massachusetts cities and towns.........	Mostly vitrified clay ..	From 8 inch's up; tot'l systems	70,000 to 80,000	....	 100
English city.....	Concrete, lined with clay pipe..	21 inch, in tunnel in gravel and sand.....	140,000		
New Orleans, La..	....	Wet soil ...	31,800	1,941	
Washington, D. C..	....	" "	....	975	
Norfolk, Va.......	....	....	....	.....	100
East Orange, N. J..	Brick	2 x 3 feet; deep trench and tunnel; wet soil..	570,000		
....	"	4 feet and 3 x 4 feet; wet soil .	800,000		

While these records are few in number and show considerable variation, still this is no greater than might be expected if we take into account the various conditions. They seem to indicate that in the systems in question from 30,000 to 80,000 gallons per day per mile of entire system leaked into the sewers, Schenctady alone falling below this. Where wet sections only were included the leakage into vitrified clay pipes was from 31,800 to 1,320,000 gallons per mile per day; into brick sewers, 570,000 to 800,000 gallons. The leakage per square foot of submerged brickwork in the two cases 13½ and 14 gallons per day respectively—shows a remarkable coincidence, but it can be considered no more than this.

It would, of course, be absurd to claim that infiltration within the above limits must be expected or provided for in all systems. The above measurements were most of them made because the sewer was known to leak. Records are seldom published of sewers which do not leak. Where there is no ground water there can be no infiltration, and there are many sections of the country and certain districts in most cities in which ground water is unknown within several feet of the level at which the sewer is placed. But in the eastern and southern states at least, ground water is found within 8 feet of the surface, during rainy seasons if not at all times, much more commonly than is realized; and sewers 15 to 30 feet deep are probably more often in wet soil than not.

Since the most ground water is ordinarily found at the lowest levels, where also the largest sewers occur, most of the above records for vitrified sewers in wet soil are probable for pipe 10 inches to 20 inches or 24 inches in diameter. It is to be hoped that future measurements will give the leakage into each size of pipe, and also the head of water on the pipe. Exact measurements are not necessary; and those involving an error of not more than 10 per cent. need not be expensive to obtain. A standard weir, or for small quantities a standard orifice, can easily be adjusted in manhole bottoms, and the head read from a gauge permanently attached to the apparatus.

Most of the above measurements were necessarily taken before house connections were made. These are too often laid more carelessly than the sewer, and, although smaller, probably admit as much ground water at each joint submerged as does the sewer if not more. Although, lying higher than the sewer, they are probably less likely to be submerged than it is, it is probable that in a wet section they will admit at least 50 per cent. as much water as the sewer—often two or three times as much.

In consideration of all the above, it seems desirable to allow for a leakage of 50,000 to 100,000 gallons per mile per day wherever a pipe sewer is land below the ground water level, and about 15 gallons per square foot of submerged brick sewer, except where the sewer is laid in a manner different from common practice.

Preventing Infiltration.

Probably the most common cause of excessive infiltration is carelessness of workmanship and of inspection, and the difficulty of making the ordinary cement joints in wet trenches; but the most carefully made cement joints are more or less porous. However, in dry ground the ordinary vitrified clay pipe and cement joint, carefully laid and proved to be so by test, would seem to be satisfactory. A test used in England is to close both ends of a section of sewer—say at the manholes—and at a branch attach a water-tight riser carried at least 5 feet above the sewer. Through this the stretch of sewer is filled, and the riser is also filled and meantime the joints are all examined for leakage; the pipe not being covered until tested satisfactorily. The writer has tested pipe from the outside in wet trenches before being covered, by building a dam at each end of a stretch and allowing the ground water to rise above the pipe within the space between dams, the interior of the pipe being inspected for leaks by mirrors used as heliotropes. By discovering leaks in this way he has obtained what seemed to be tight sewers. It would seem desirable that a test similar to one of these be applied to all sewers when laid, and to all house connections, and none accepted until practically tight.

To make a tight sewer requires that both pipe and joint be tight, if pipe is used; or that the material of which the walls of a sewer be constructed be tight, if the sewer be built in place. Probably the surest way to make a tight sewer is to use cast iron pipe and lead joints, but this is expensive, even when the lightest weight iron pipe is used. With pipe at $30 per ton, 8-inch iron pipe sewer would cost about 40 cents per foot more than vitrified; 12-inch, 70 cents more; 18-inch, $1.10 more; 24-inch, $2.00 more; a very considerable increase. However, where the ground is wet and liable to slight settling or jarring probably cast iron pipe is the best construction.

Wrought iron pipes has not, as far as the author knows, been used for sewers; but it seems probable that where it would be more desirable than cast iron as a water conduit under light pressure, it would be as a sewer also except where there might be considerable erosion.

Wood pipe, either bored logs or wood-stave, can be made practically tight, but if untreated would be too absorptive for general use, becoming soaked with putrid sewage. But creosoting probably removes this objection. There might still be an erosion, however, much greater than with vitrified pipe or brick. The use of wood, both treated and untreated, has been more or less common; creosoted stave pipe is used in New York and Brooklyn for outlets: a stave pipe 7 feet 2 inches diameter and 8 inches thick was built in Boston in 1882, and although not treated was sound in 1902. Another similar one in the same city 10 feet 6 inches diameter was lined with 4 inches of brick.

"Silicate" sewers, of sand and sulphur, and other pipes of other materials have been tried from time to time, but none have proved successful, and most were very expensive.

Joints are the weak points in all pipe sewers, and the less there are the better, speaking generally; for which reason 3 feet lengths of sewer pipe are better than 2 feet. By far the largest proportion of sewers in this country carrying house sewage only is of vitrified pipe with cement joints, and it is of importance to consider whether such can be made impervious. The evidence would seem to indicate that this is impossible. Even joints made in the laboratory with the greatest care permit appreciable infiltration. But with careful, conscientious work such joints can be made, the writer believes, which will not permit an infiltration exceeding 1,000 gallons per mile per day for each inch of diameter of pipe and each two or 3 feet head of ground water above the same.

Tighter joints are made in Washington, D. C., and in some other cities, by bedding the sewer pipe in concrete and carrying a band of concrete up over the joint. The writer has made practically tight joints by filling the "bell hole" in the bottom of the trench with concrete and carrying a band of the same up over the pipe. Both of these methods of course add considerably to the cost.

One common cause of leaky joints is the sliding of the mortar out of the joint after it is made, either because originally too wet or because softened by water in the trench. This is prevented by filling the bell-hole with concrete; or some engineers wrap cheese-cloth around the joint as soon as it is made, to hold the mortar in place, which also prevents the mortar from being knocked out of the joint by falling dirt. Mortar is generally retained in the joint more surely if deep-belled pipes be used; as they always should be, in the writer's opinion.

It seems probable, if not certain, that tigher joints result generally from a mixture of one to two parts of good sand with the cement than from neat cement mortar.

Another common cause of leaky joints is the settlement of the pipes after the joints are made. This is obectionable because of the grade also, and should be prevented in every case by suitable precautions.

There are many patent joints made in England, some of which have been used to a considerable extent, in which the general idea is to pour cement grout into the joint, as in making a lead joint in cast iron pipe; others in which a composition material is attached to the outside of the spigot and inside of the bell, and there turned to conical surfaces which are greased and pushed together, fitting tightly; but all of these are expensive, and it is thought have never been introduced into this country.

Asphalt has been used for filling joints to a very limited extent in Germany and in this country. It can not be considered to be permanent in contact with water and is easily soluble in a number of substances found in some sewages.

Mr. Kenneth Allen states that tight joints were made in Atlantic City by use of Rosendale cement kneaded into North Carolina pitch pine

tar, the joint space being completely filled with this homogeneous mixture.

About the only materials used to any extent for building sewers in place (aside from riveted steel and wood-stave) are brick and stone masonry, and concrete both plain and reinforced with steel rods or wires. To the perviousness of the ordinary brick sewers reference has already been made. But a block (brick or stone) sewer can be made fairly tight if of more than one ring without any great expense. The author's method in wet trenches is to complete the outside ring up to the springing line, leaving out a brick here and there if necessary to permit the ground water to enter the sewer and escape over its invert. As soon as the mortar —which should be of quick-setting cement—has set all openings are filled and this outring made water tight by plugging any leaks with wood splinters, oakum soaked in cement, or some other way. A quarter-inch layer of rich mortar is then plastered over the inside of this ring and the other rings laid as usual. The arch is carefully plastered with a half-inch of rich mortar troweled down to a dense continuous coating. Such a brick sewer will not be absolutely tight, perhaps, but will be nearly so.

Concrete sewers, if of well mixed and properly proportioned material, and made continuously or so bonded that there are no seams through the shell, are practically water tight. Various methods of making concrete almost if not completely impervious were discussed before the American Society of Civil Engineers recently; but good workmanship and materials intelligently applied are sufficient for all ordinary cases. If the trench is full of springs the invert of a concrete sewer may be constructed of two rings, small pipes being built into the outer ring extending through it so that the ground water may enter the sewer until the concrete has hardened, when these pipes are plugged, and the inner ring built in this dry cradle.

In general if mortar be made of 1 cement to 2½ or 3 sand; and concrete of 1:2:4 or 1:3:5; and if care to be taken that all parts of the masonry are absolutely filled with either mortar or stone or brick until set, and that no seam or joint extend continuously more than half way through the shell; such masonry will generally be reasonably tight—much more so than the cases cited above.

The author hopes that this paper may bring forth data and opinions as to the amount of infiltration to be expected with reasonably good materials and workmanship; and descriptions of methods found successful in reducing infiltration in very wet ground.

MR. REIMER: Mr. Folwell has quoted East Orange as having plenty of small sewers and plenty of water in them. I had occasion four years ago to build a line of trunk sewers ten inches in diameter, but it went through a piece of land where the ground water stood on top of the ground almost all the time. Two thousand feet of it was under water most of the year. The soil was the ordinary swamp muck, then a clay formation, some hard pan, and underneath that hard pan. Part of our sewer had to be built through the hard pan formation. We made a tight sewer of pipe and cement joint, so tight that after it was all completed you could find scarcely any water at all in it. The city built it, and it cost a great deal of money. I instructed my foreman that that work was to be done as well as he could do it, and that every precaution should be taken to see that the joints were tight, first caulked with oakum and then filled with well seasoned cement. He was so conscientious in his work that when he discovered a little leak in a stretch that was completed, he took it up and repaired it at his own expense so he would not be blamed for that leak. That was the only leak discovered in 3,500 feet of pipe.

I believe sewers of that kind can be made perfectly tight, but not by the ordinary contractor. We cannot leave it to somebody who simply wants to get the work done, regardless of whether it is done properly or not. We shall have to train conscientious men to do this work if we can. I believe with the proper kind of men and the proper material we can make sewers tight, and there will be no such quantity of water as reported by Mr. Folwell going through the ground. Then they will be used for the purpose they are intended, and nothing else.

MR. RANKINE, Newark, N. J.: I was very much interested in the paper. Last month I was called on to report on a section of the joint outlet sewer which drains five or six of the smaller municipalities in the neighborhood of Newark. One of the questions put to me was to give a reasonable definition of a substantially water tight sewer. I looked up the question as far as I was able, and found results similar to Mr. Folwell's. I found that the conditions under which sewers were built varied so greatly it was almost impossible to get any definition of this term. I learned only a day or two before I left home that there would be a paper on this subject, or I should have taken pains to bring more data in regard

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to the matter. The section under discussion was a brick sewer forty-two inches in diameter. It was built, I should judge, two-thirds of it below the ground water level, although I did not see the work of construction. Gaugings were taken a few days after an unusually severe storm in which some ten inches of rain fell inside of two days. The ground water at that time was no doubt practically on the surface. I took a gauging at the upper end of the brick sewer and another at the lower end. I think there were two and one-half miles of the sewer I am not positive about the number of miles of sewer coming into it, but I am told there were fifteen miles. At the upper end I found 107,000 gallons per mile. In one of the smaller sections which drains through a fifteen-inch pipe, and drains about five miles of sewers, I found about 2,500 gallons per mile. This gauging, however, was taken after the rain of which I spoke. The engineer has taken a great deal of pains about his joints, and has used, among other things, a mixture of Portland cement and tar, which has given fairly satisfactory results. He is now making an experiment by putting together four lengths of three-foot pipe on the surface, making 12′ sections, and then lowering them into the main so that he gets only one joint in the ditch for every twelve feet.

PRESIDENT RUST: Before closing we will have to have two committees appointed, one for the next place of meeting and one for nominations of officers. We are now ready to receive nominations.

The following Committee on Place of Meeting was appointed: Emmet Steece, Burlington, Iowa; William Fortune, Indianapolis; Dr. Vinson, Newark; Mr. Chaussé, Montreal, and N. P. Lewis, Brooklyn.

On Nomination of Officers, the following committee was appointed: Mr. Benzenberg, Milwaukee, Wis.; Mr. Sherrerd, Newark, N. J.; Mr. Jones, Toronto; Mr. Murphy, Burlington; and Mr. Charles C. Brown, Indianapolis.

The session was then adjourned.

THIRD SESSION.

The third session was caled to order at 8 p. m., Wednesday, October 21st, President Rust in the chair.

PRESIDENT RUST: We adjourned this afternoon before we finished discussing Mr. Folwell's paper. Several members have expressed a desire to discuss it further; but I think we had better leave that for the morning session, and devote this session to the papers relating to the City of Indianapolis. The first paper relating to this city is by Mr. James B. Nelson, formerly city engineer, on the street paving of this city. I am sorry to say that Mr. Nelson has been called out of the city by the death of his father, but Mr. Buehler has kindly consented to read Mr. Nelson's paper.

THE PAVING SYSTEM OF INDIANAPOLIS.

BY JAS. B. NELSON.

The State of Indiana was admitted into the Union in 1816. In the year 1819 Congress gave to the state four sections of land as a site for the permanent capital of the state. These four sections were to be selected from any of the unsold public lands within the borders of the state. In the same year the State Legislature appointed a commission of ten men to make the selection, and on the 7th day of June, 1820, after a great deal of wrangling and difference of opinion, they chose the site of the present city and named it Indianapolis. The argument advanced at that time in favor of this name was that the Greek termination of the word would indicate to all the world the location of the city—the City of Indiana.

It was at that time far from any settlement, the nearest store being 60 miles away; but it was very near the geographical center of the state, and is to-day, 83 years later, very close to the center of population of the state, as well as the United States, the exact center of population of the United States in 1900 as established by the Government authorities being but a few miles south of the city.

It was not until five years later, in 1825, that the capital was moved to Indianapolis from the old territorial capital of Corydon, a small village in the southern part of the state, some miles back from the Ohio River.

The original town—what we commonly call the original mile square—was laid out by Alexander Ralston, a surveyor who had been concerned in Burr's expedition, the failure of which left him in the West. Ralston had, when young, assisted in the survey of Washington City, and the ideas obtained in that work were employed to some extent in the general plan of this city. The Circle, 3.12 acres in area, now occupied by the State Soldiers' and Sailors' Monument, is the center of the square, around it being an 80-foot street. From the extreme corners of the four adjacent squares, avenues 80 feet in width, lead to the northeast, northwest, southeast and southwest. The first street south, Washington Street, running east and west, was made 120 feet in width. The remainder of the mile square was laid off into regular squares of 420 feet separated by 90-foot streets, following the cardinal points of the compass, each square having a 30-foot alley running east and west, and a 15-foot alley running north and south. Many of these alleys are now dignified by street names.

The original mile square is bounded on the east, west, north and south by East Street, West Street, North Street and South Street respectively, the other original streets all being named after states of the Union with one exception, the exception being Meridian Street, which would, if extended, pass through the center of the circle, and which divides the mile square into east and west halves. Unfortunately, outside the original mile square, this ideal plan has not been followed closely, most of the streets not being so wide. But the four diagonal avenues have been extended.

It may be of interest to note that Washington Street, at present the most important thoroughfare of the city, formed a part of the old National Road, inaugurated in 1806, beginning at Cumberland, Maryland, and crossing West Virginia, Pennsylvania, Ohio, Indiana and Illinois to St. Louis, a distance of about 800 miles. That part of the road in the vicinity of Indianapolis was built in 1833 and 1834 under the supervision of Maj. Ogden. It includes the construction of a two-span wooden bridge over White River which was in service until last year, when it was removed to make way for a new bridge. The appropriations by the National Government for building and maintaining this road continued to 1839, when the Government gave that part of the road within its boundaries to the State of Indiana.

THE FIRST STREET IMPROVEMENT.

In 1847 the State Legislature granted a city charter to Indianapolis. The estimated population at that time was 6,000. Practically the only street at that time was Washington Street, and it was still full of stumps. This marks the beginning of the street improvements of the city, the new city council at once entering upon a systematic and general system of street improvements. Stumps were pulled out, the streets in the central portion of the city graded and graveled and sidewalks were built. It is a source of satisfaction to some of us who in recent times have had in charge the carrying out of public improvements and who have been subjected to abuse and vilification by irate property owners, to know that at this early period in the citys' history a great deal of friction and litigation resulted from this first attempt at street improvements, the property owners objecting strenuously to the expense entailed upon them. Bouldering for streets was introduced in 1850 when Washington Street, between Illinois and Meridian Streets, was so paved. Later considerable paving of this kind was done, but practically all this has been supplanted in recent years with more modern pavements.

MODERN PAVEMENTS.

The modern paving system of the city can be said to have originated in the year 1888, when Washington Street, from Alabama Street to Mississippi Street (now Senate Avenue), was paved with a tar macadam known as vulcanite, there being about 20,000 square yards of it. This pavement was laid in three layers to a total depth of 8½ inches. I quote from the specifications as follows: "Said pavement shall be what is known as Filbert Vulcanite Asphaltic Pavement, improved by Murdock patent No. 394,126, and shall be equal in every respect to that laid on 'K' Street between Ninth and Eighteenth Street N. W. Washington, D. C., in 1874 and 1875." There was a provision in the specifications that the cost should not exceed $2.60 per square yard. The following year, 1889, about 13,500 square yards of the same kind of pavement was laid in Illinois Street, from Jackson Place to Washington Street; Pennsylvania Street, from Washington to Ohio Streets, and Court Street, from Pennsylvania Street to Delaware Street. Of these, only the last named, about 900 square yards, is still in use. Pavements in Washington Street and Pennsylvania Street were resurfaced with asphalt in 1898 and 1899 respectively, after having been down 10 years, and the Illinois Street pavement was resurfaced with asphalt in 1901, after a life of 12 years.

ASPHALT STREETS.

In the year 1889 an ordinance was passed for the first sheet asphalt street in this city—Pennsylvania Street from Seventh (now Sixteenth) Street to Exposition Avenue (now Nineteenth Street). The improvement was not made, however, until the following year, when five streets were paved with asphalt, a total of about 37,640 square yards. Trinidad asphalt was used, a 2½-inch wearing surface without binder being laid on a 6-inch hydraulic cement concrete foundation. All these pavements laid during the year 1890 are still in service with one exception—Washington Street, from Alabama Street to the L. E. & W. R. R.—which is being resurfaced at the present time. One street paved originally in 1892 has been resurfaced during the present year, Illinois Street, from Washington Street to Ohio Street, was resurfaced in 1901 after being laid 10 years. This is the shortest life of any asphalt pavement laid in this city. These pavements all had a 5-year guaranty. Proper provision was not made for taking care of them after the guaranty expired, or they might have been made serviceable longer.

In 1896 the guaranty period for both asphalt and brick pavements was increased from 5 to 9 years, and the specifications were modified to provide for a 2-inch asphalt wearing surface on a 1-inch binder, which is the present practice. All asphalt, brick and wooden block pavements are now laid on a 6-inch Portlant cement concrete foundation, all asphalt pavements having brick gutters. At the present time the City of Indianapolis has a total of 1,006,610 square yards of asphalt pavement, of which 377,840 square yards is under guaranty by the original contractor and 627,770 square yards on which the guaranty has expired.

Previous to the present year but one street had been paved with other than Trinidad or Bermudez asphalt. Indiana Avenue, from West Street to Fall Creek, was paved in 1897 with Kentucky Rock asphalt.

Three contracts amounting to 18,775 square yards have been completed during this year of "Obispo" California asphalt. Indianapolis has no block asphalt streets.

Altogether since the present system of paving was adopted, eight resolutions have been passed for resurfacing vulcanite and asphalt streets, and the cost thereof has been assessed against the abutting property the same as original construction. In some cases the property owners have objected strenuously to this, claiming that resurfacing should be paid for by the city. In a suit, recently, one of the local Superior Courts decided against this contention of interested property owners, and an appeal has been taken to the State Supreme Court.

The estimated average cost of standard asphalt pavements in Indianapolis at the present time, with a 9-year guaranty, is $2.10 per square yard, not including grading. This includes 1-inch binder and 2-inch wearing surface on a 6-inch Portland cement concrete foundation.

BRICK STREETS.

For streets subjected to heavy traffic brick has given very good satisfaction as a paving material, and while not so popular as asphalt or creosoted wooden block for residence streets, yet it has been used not a little for such purpose. Indianapolis has had a somewhat varied experience with brick pavements; some have been poor and others first-class. Some of the first pavements being bad had a tendency to bring brick into disrepute for a time, but recently brick streets have become more popular, bv reason of care being exercised in the selection of the brick themselves, and the manner of laying them. Brick are used for paving alleys almost exclusively. The first brick pavements were put down in 1891, since which time 448,000 square yards have been laid, not including streets paved during the present year, 103,100 square yards being under guaranty at the present time, and 344,900 square yards on which the guaranty has expired. The present practice is to lay the brick with a 2-inch sand cushion on a 6-inch Portland cement concrete foundation, and grout with one to one Portland cement filler. No expansion joints are provided. In the past some alley pavements have been made on a rolled gravel or broken stone foundation, but this is no longer done. Not including grading, the average estimated cost of brick pavements at the present time, with a 9-year guaranty, is $1.70 per square yard.

WOODEN BLOCK STREETS.

While not strictly speaking the first, yet in a sense, Indianapolis may be said to be the first city in the United States to build creosoted wooden block pavements. This subject has been thought of sufficient interest to you to warrant the presentation of a paper especially devoted to it, hence I shall refer to the subject only briefly.

Including the contracts now under construction, Indianapolis has 350,205 square yards of wooden block pavements, of which 236,760 square yards have been creosoted. The first of these pavements was put down in 1895, in Alabama Street, from Ohio Street to Ft. Wayne Avenue, of round cedar blocks, untreated, on a rolled broken stone foundation. This pavement is rough to drive over, but the blocks are in a fair state of preservation and it has been repaired but little. In the following year 44,500 square yards of rectangular Washington red wood block pavement was laid in Meridian Street and Central Avenue. These blocks were untreated. At the time they were laid, Mr. Brown, who was then city engineer, informed the property owners that they could not be depended upon to wear longer than six years. Considerable repairing has been done, but they are good for two or three years longer after having been down eight years.

Later some blocks were laid which were merely dipped in the preservative, as Mr. Reilly will explain to you. The first creosoted wooden block pavements were laid in 1898.

Not including grading, the average estimated cost of creosoted wood block pavement in Indianapolis this year has been $2.80 per square yard, with a 9-year guaranty. This includes a 6-inch Portland cement concrete foundation and the blocks are treated with 12 pounds of Kreodone oil.

MACADAM PAVEMENTS.

Indianapolis has very little stone macadam pavement, the one important thoroughfare being Capital Avenue, from Indiana Avenue to Thirty-fourth street. Part of this street was shown you this afternoon, during the drive about the city, which was built in 1898.

This was a very expensive pavement, the material being laid in four layers to a total thickness at the center of 19 inches, the top layer of 4 inches being granite.

Approximately 50,000 square yards of flint rock macadam pavement has been laid on residence streets this year at an estimated average cost of $1.30 per square yard, not including grading. This has been built with 30-inch brick gutters.

GENERAL PLAN OF STREET IMPROVEMENTS.

After the main business thoroughfares were improved, the general plan laid out provided for improving first the north and south streets within the "mile square," next the east and west streets within the "mile square," then the main north and south streets outside of the "mile square." and last the east and west streets, or cross streets, outside the "mile square."

There has been some departure from this plan, but in a general way it has been followed. The first street improvements were made with rather wide roadways, but the tendency in recent years has been to decrease the width of the improved roadways. The roadway of a 60-foot residence streets on which are no street railway tracks is now never made more than 30 feet between curbs, and a street 70 feet or more in width not more than 36 feet between curbs. During the past two or three years fully three-fourths of the residence streets have been improved to a width of 24 feet between curbs, these improvements, you understand, being made away from the central portion of the city. This gives sufficient width of roadway for all practical purposes, gives greater width of lawns in front of the houses, and decreases materially the first cost of the improvement to the abutting property, and the cost of maintenance to the city.

During the past few years nearly all sidewalks have been built next to the curb where possible to so locate them without disturbing shade trees. This may be said to have developed into a fad in this city. Many comparatively good brick walks on the property line have been torn up and new cement walks built next to the curb, so that the property owners may obtain wider lawns between the walk and their houses. I am apprehensive that this may lead to encroachments on the street in the future. It has already resulted in some cases in reducing the practical width of the streets, as houses have been built directly on the property line. This method of construction presents some engineering difficulties which I shall not attempt to discuss at this time.

PRESENT CITY CHARTER.

While the modern system of streets improvements was begun previous to that time, the greater part of it has been carried out since the adoption of the present City Charter, which was given to the city by the State Legislature in 1891, and which I shall briefly review so far as it relates to street improvements. The theory of this charter is that there shall be one responsible executive head, the mayor, who appoints all the boards and heads of departments and who is elected by popular vote for a term of two years. The legislative department is imposed in a Common Council composed of twenty-one members, elected for a term of two years at the same time the Mayor is elected.

Th Board of Public Works, consisting of three members, has charge of all public improvements. The members of the Board of Public Works, as well as the City Civil Engineer, who is subject to the discretion of the board, are appointed by the Mayor. When the Board of Public Works decides to order the improvement of any street, it is required to adopt a resolution setting forth a description of the same, including full detail drawings and specifications, and setting a day on which all interested property owners may be heard. Notice of such resolution is published once each week for two weeks. On the day of hearing the board may modify, confirm or rescind the resolution. On or before the day of hearing, the City Civil Engineer is required to file with the board an estimate of the total cost of the proposed work, and no contract can be let which shall exceed this estimate. Nor can a contract be let for the improvement of any street, alley or sidewalk, the total cost of which exceeds 25 per cent. of the aggregate appraised value of the property subject to be assessed to pay for said improvement, the appraisement being made by three disinterested free-holders, appointed by the Board of Public Works. This last restriction does not apply to sewer resolutions.

If at any time on or before the day of hearing a petition shall be filed with the board by resident free-holders on the street proposed to be improved, asking that "said street or alley be paved with any certain kind of the accepted kinds of modern city pavements," then the board has not the power to improve it with any other kind of material unless their action is approved by an ordinance passed by a two-thirds vote of the Common Council. If more than one such petition is filed asking for different kinds of pavements, then the board must grant the petition on which appears the names of the most resident property owners. All such petitions, as well as remonstrances, are referred to the City Civil Engineer for investigation, who reports to the board. This feature was not a part of the original charter, but is an amendment passed by the legislature in 1899, the amendment being prepared by Ex-President Benjamin Harrison, under the following circumstances: The Board of Public Works had adopted a resolution for paving Delaware Street in front of Ex-President Harrison's residence, with asphalt, and was not disposed to modify the resolution to provide for creosoted wood block, which a majority of the property owners desired, the principal reason being, I think, that part of this street had already been paved with asphalt and the board desired to continue the same kind of pavement. The State Legislature being in session at this time, this amendment to the charter was introduced and passed. This street was then paved with creosoted wood block, which most of you had an opportunity of seeing this afternoon. This amendment to the charter, while perhaps all right in theory, has not worked well in practice. It renders it impossible for the Board of Public Works to carry out a uniform and harmonious system of improvements. As a result we have in some cases, two or more kinds of pavements on the same street, within a distance of a few squares. The petitions presented are rarely ever an honest expression of what the property owners really prefer. Misrepresentations are made to them by paid representatives of the different paving companies, who are instrumental in circulating the petitions, especially those who are financially interested in some other paving material than that specified in the resolution. To such an extent has this business been carried, that in some cases the surest way of getting the kind of pavement really desired, is to adopt a resolution providing for some other kind of material.

After confirming or modifying a resolution, ten days must then be given for filing of a final remonstrance. If within this time a majority of the resident property owners along the proposed improvement, remonstrate against the improvement, the board has not the power to proceed with the same unless it is done pursuant to an ordinance passed by a two-thirds vote of the Council and approved by the Mayor. Should there be no effective remonstrance, the board may proceed to advertise for bids. In case of a street or alley improvement the contract must be made at a price per lineal foot each side. When the contract has been completed, the board has an assessment roll made, which it adopts and advertises in very much the same way the improvement resolution is adopted, property owners assessed being given an opportuity to be heard on the question as to whether they are benefited to the extent of their assessments. When the final assessment roll has been approved, the assessments for the improvement may, at the option of the property owners, be paid in ten annual installments with six per cent. interest on deferred payments.

PAVING BETWEEN STREET RAILWAY TRACKS.

Under the terms of its franchise, the Indianapolis Traction & Terminal Company, the local street railway company, is required to pave between its tracks and 18 inches on each side thereof, with the same material and in accordance with the same specifications under which the rest of the street is paved, unless permitted by the Board of Public Works to use some other paving materials. On brick or creosoted wood block streets, this space is paved with the same material. On asphalt streets it is now the universal practice to permit the street railway company to pave between its tracks with brick.

MAINTENANCE OF PAVEMENTS.

The City of Indianapolis is just beginning to realize the importance of making proper provision for maintaining its improved streets. This is the first year that an appropriation has been made for this purpose at all commensurate with the needs. As a result of this in the past the asphalt pavements, especially, have been more or less neglected, and it has been necessary to resurface some streets when the original pavement had been down but ten years. A fund of $50,000 has been available for the year 1903, for repairing the so-called permanently improved streets. This fund has been practically exhausted at the present time, $39,477.75 having been expended on the asphalt pavements. I estimate that about $3,000.00 additional will yet be used for this purpose before the end of the year. The number of square yards maintained is 589,680, embracing all the pavements on which the guaranty had expired at the first of the year, except three streets which it was considered advisable to resurface. Including the estimated expenditure yet to be made, the average cost per square yard this year will be $0.072. During the year 1902, for the same pavements, the average cost of repairing was only $0.0232. This latter sum, however, was insufficient, and the repairs could be made only in a very incomplete manner. More money could have been used to advantage had it been available. None of these pavements have been laid longer than 13 years and none less than 8 years, the average being about 10 years. All were built with a 5-year guaranty. The guaranty period was changed in 1896 from 5 years to 9 years so that no guaranties have expired since the year 1900 and no more will expire until 1905.

Using as a basis the average character of the asphalt pavements built in this city it is my opinion that for maintaining the same after the expiration of the 9-year guaranty period the most economical plan in the end should provide for an average repair fund of about 10 cents per square yard per annum. By so doing, and by making the repairs judiciously and at the proper time, it will be practicable to maintain them for a further average period of six or seven years. This is approximately five per cent. of the original cost per annum. In Indianapolis at the present time, this would mean an available yearly repair fund of $58,968.00.

The patching has been done by contract with one of the asphalt companies at so much per square yard of actual measurement of patches.

The price this year has been $0.95 for "skim patches," $1.30 for resurfacing an old concrete, and $1.90 for new concrete and pavement. Very little new concreting has ben done and practically no skim patching. During a part of this season the Economic Asphalt Surface Heater, controlled by Mr. F. O. Blake, of Cincinati, was used. With this machine 10,836 square yards of repairing was done at an average cost of $0.805 per square yard; Mr. Blake being paid for the use of the machine twenty-five per cent. of the cost of all labor and materials, the city furnishing a steam roller and all necessary tools. Nothing is included in the above cost for the use of the roller and tools. This machine although received with some misgivings at first, gave very good satisfaction. It was not used on the worst pavements, its advantage being for use on pavements which have not been too long neglected.

Our brick and wooden block pavements not under guaranty have been repaired by day labor under the supervision of the City Civil Engineer. I am not able to state just what this work has cost, as heretofore a record of it has not been kept in a systematic manner. The guaranty period has expired on only the first wooden block pavements put down, which were laid in 1894 and 1895, and which were not creosoted or treated in any manner. The patching has been done with creosoted blocks.

AREA OF CITY, ETC.

The City of Indianapolis has a total area of 29.35 square miles. From its northern boundary to its southern boundary it measures 6.50 miles; from east to west it measures 8.67 miles. The city has a total length of streets of 445 miles. At the beginning of the present year 95.42 miles of streets and alleys were improved as follows: Paved with asphalt, 46.10 miles; paved with brick, 27.35 miles; paved with wood block, 17.31 miles; paved with macadam, 4.66 miles. Many miles of streets have been graveled, an exact statement of which is not at hand.

LOCKERBIE STREET.

In closing I want to call the attention to a little street that has become famous because of its association with the Hoosier poet, whose home was situated on it. His home has been here for twenty years or more.

Mr. Riley's discovery of Lockerbie Street, impressed him so much that he indited a poem. The part he refers to is but a block long, a roadbed of gravel, greensward on the sides, fine old trees with flowers and lawns in front of the old-fashioned houses. The march of improvement has not marred its original quaintness and beauty, and it is yet as when he wrote,

"O, my Lockerbie Street! You are fair to be seen—
Be it noon of the day, or the rare and serene,
Afternoon of the night, you are dear to my heart,
And I love you above all phrases of art,
For no language could frame, and no lips could repeat,
My rhyme-haunted raptures, of Lockerbie Street."

President Rust: The next paper is one by Mr. Riley, on The Development of the Kreodone Block Pavement.

THE DEVELOPMENT OF THE KREODONE BLOCK PAVEMENTS.

BY MR. RILEY.

In this city in 1896 the first step was taken towards the present improved wooden block pavement. The blocks were cut from Washington cedar, a wood described by the Department of Agriculture, Division of Forestry, Vol. 9, Tenth Census, Forest Trees of America, as very light, soft, not strong, brittle, rather coarse grained, specific gravity .38, weight per cubic foot 23.66. The specifications for treatment required that the blocks be dipped in creosote oil. Instead of dipping, however, the blocks were subjected to the same preparatory treatment for the reception of the oil as is now employed; and the oil was injected into the blocks by pressure. But as the price of treatment was based on the process of dipping, necessarily very little oil could be used. and only two and a half to three pounds of oil to the cubic foot were used, a quantity wholly insufficient for more than a brief temporary effect. The blocks were cut 3x5x6 to 10 inches long, and 4x5x6 to 10 inches long. In the street they were laid close and then driven together; no allowance was made for expansion.

These streets constructed of a wood entirely unsuited for paving purposes and only superficially treated with oil are classified as creosote block. They can hardly be so termed. But, the result of this very light treatment demonstrated to the city authorities that creosote oil, even in small quantities, had a most beneficial effect on wooden blocks. For these pavements compared with precisely the same kind of pavements laid without any treatment showed much greater resistance to wear, and for nearly five years the surface of the block remained non-absorbent to the extent that after a rain the surface remained dry and did not broom or soften; while the untreated, after a rain, immediately broomed and became soft and spongy.

The city authorities were soon to recognize that cedar was not the wood to use, and that the oil treatment was deficient in quantity. The following year the specifications were changed. Long leaf yellow pine, a wood described by the Department of Agriculture, Division of Forestry, Vol. 9, Tenth Census, as heavy, exceedingly hard, very strong, tough, coarse, grained, compact, durable; specific gravity .70. Weight per cubic foot 43.62 pounds, was substituted for the Washington cedar, and the quantity of oil increased to 10 pounds to the cubic foot. These specifications remained unchanged for two years, when the city again increased the quantity of oil to 12 pounds, or an increase of 20 per cent. The result of the increased quantity of oil did not give to the blocks the waterproof qualities the city expected it should, and which it deemed necessary they should possess; for when the blocks were driven close together the expansion caused the blocks to raise in spots, generally in the gutters next the curb. The cause was two-fold, the creosote oil was seriously defective in many particulars, especially in permanency, and insufficient in the quantity used. The city's judgment, however, that a long leaf yellow pine block treated was a most durable pavement, was fully substantiated, for the blocks in the earlier pavements show practically no wear, and what there is, in very uniform. In fact there is the wonderful record that in the many miles of streets in this city and in other cities there is not the slightest uneveness in wear. There is not a single block showing greater wear than the entire body of blocks, and none of the blocks show any deterioration. But believing that 12 pounds of oil, if it were of the proper quality, were sufficient for the purpose of preservation, and for the purpose of thoroughly waterproofing the blocks, the next step by the Board of Works was an examination into and a study of creosote oil. Samples were obtained at different times from the chief distillers in the country, and frequently tests were made. It was a most important and a most fortunate investigation, both from an educational and a practical viewpoint, for it conclusively showed that what is known commercially as creosote oil varied very greatly in quality, was extremely volatile under temperature much less severe than that which blocks in the street are exposed, therefore, lacking in fixity, and more or less soluble in water, some considerably so. The dependence that had been placed in commercial creosote oil proved to be unwarranted, and that the general specification, creosote oil, would not be productive of satisfactory work. To fill the requirements Kreodone creosote oil was presented. It was uniform in quality, possessed great resistance to heat and atmospheric influence, and was very much less soluble in water than any of the others. Since then it has been practically insoluble in water.

At the time of the introduction of this form of pavement there were no references obtainable that were of practical assistance. We had recourse to three. The creosoted block pavements of New Orleans and Galveston, the reports in the Government office on the efficacy of creosoting, and the success in London and Paris and other European cities of creosoted block pavements. The Galveston and New Orleans pavements were laid with wide interstices, filled with sand—very inferior and unsatisfactory construction, first, because the joints were dirt gatherers and distributors, and second, because blocks, set apart, round at the edge as does granite. We learned nothing of the expansion of the blocks because the wide joints provided for it and it was not noticeable. The Government records referred generally to the treatment of timbers, marine work, railroad sleepers, etc., but not to paving blocks.

The reports from Paris and London referred to heavily traveled streets, where in many instances the streets wear out before they could deteriorate. I have not the slightest doubt that a continuously heavily traveled street, as is found in these cities, a light treatment would suffice. The travel itself crushes the blocks to such an extent as to make them watertight.

We had presumed from these references that all that was needed was to inject creosote oil into the block to protect it against decay and that the work was done; that the blocks could be driven together in the street. Experience quickly obtained, soon taught us that preserving the paving block was a very good thing, but it was only a part of the work to be done; the other part was that the block should be made proof against absorption.

In this connection I might suggest that creosoting wood is partly similar in intent to the tanning of hides as in leather making. The proper oil has somewhat the property of combining with the fibre as tanning combines with the fibre of the hides, to form a non-putrescible compound. This compound may or may not be waterproof according to the circumstances, and besides the oil needed to fulfill this "tanning" of the wood fibre, enough oil should be used to fill the intercellular spaces of the wood and waterproof the block as a whole, by absolute exclusion of water from the interior of the block.

It is required that the wooden paving block be of such a character that it possess great resistance, that the blocks be laid perfectly close together and be proof against the elements. Long leaf yellow pine is the principal wood used so far, though fir, tamarack, elm, beech and Norway pine are more accessible, either of these woods can be used. In its green state long leaf pine weighs 58 pounds; dry about 38 pounds to a cubic foot. A cubic foot of dry timber contains 25.5 pound volumes wood substance, and 37 pound volumes voids. One-half of these voids are in the fibres; the other half are intercellular, that is, voids among the fibres of the wood. These voids or intercellular spaces should be filled with an oil possessing not only germicidal and preservative properties, but oil that is waterproof in character, that will firmly adhere to the fibre, and will remain fixed in the pores. Every one of these features is essential to the success of the pavement. The resistance of long leaf yellow pine to crushing strength is about 8,500 pounds to the square inch, a resistance very much in excess of any weight or traffic it may be called upon to bear. This is its inherent strength. It is a disputed point among scientists whether the treatment of timber increases its strength or not. A celebrated German scientist, Dr. Boehme, Vol. 9, Tenth Census, says it does, and that the increase is about 20 per cent., but it is an unsettled question. But considering the matter purely from the standpoint of paving, exposed to alternate wetting and drying, I should say, that the fibre of the wood is not increased in strength in the treated block, but that it is so protected that it retains its inherent strength. To emphasize this point more fully, if a thoroughly dry pine block and a Kreodone block made from the same stick were placed side by side under cover and subjected to the same traffic conditions, the untreated block possibly would wear as well as the treated block: but in the street subjected to wetting and drying the untreated block, when wet, would become limp and very susceptible to destruction, whereas, the treated blocks, being impervious to water, its fibres would be dry on such exposure, and, therefore, would always possess their inherent strength. The theory has been advanced that some of the materials used for preserving timber, because it fills the pores, supports the fibre. As the material injected of itself does not possess any power of resistance to compression, I do not believe it adds anything to the strength of wood except in the way of protecting the fibres as I have mentioned.

I shall assume, therefore, that the strength of the wood is not increased because of the treatment, but that it simply retains its inherent strength. I will assume a dray weighing 4,000 pounds, carrying 20,000 pounds, total 24,000 pounds. The tires 3 inches wide, and the periphery of the wheel resting 3 inches on the pavement, or 9 square inches to a wheel. The compression on the pavement in this case, which is an extreme one, would be only 667 pounds to the square inch, or about one-thirteenth its power of resistance. If, however, the blocks be so treated with an unchangeable fixed material that will retain its strength under all conditions and for all time they will make a most durable pavement.

I have stated that there are about 20 pound volumes voids in the intercellular spaces of the block, which means that it will require 20 pounds of material to perfectly coat the fibres of the wood and to fill the pores, and this is the quantity I should advocate using. But, I might be asked the question, that if the Kreodone oil is waterproof and unaffected by heat and cold and the fibres of the wood are coated with it, what possible injury could occur to the fibres, or to the constructed pavement if water did enter the pores; and again, I might be asked, what would be the purpose of using a greater quantity of oil than is required to coat the fibres? I will here read a report of tests made by the city engineer made on Kreodone blocks filed by two bidders last June. These tests show that blocks treated with 12 pounds of Kreodone oil were impervious to water. But there is this possibility, that if the minimum quantity of oil is used, some of the fibres in some of the blocks may not be completely coated, and, therefore, using the minimum quantity we go too close to the factor of safety. If the intercellular spaces are filled with Kreodone oil we know that the fibres are not only absolutely coated and protected, but that the block itself is impervious to water.

What is the Kreodone wooden block as now constructed? It is a wooden block possessing great powers of resistance, unchangeable in character, and having an absorption of moisture less than brick. In the street the blocks can be laid close together, and in this way get the superior construction due to the edges of the blocks supporting each other, making a practically continuous surface. No pavement, not even granite will wear as well. I do not wish to be understood as claiming that Kreodone block has as great resistance to compression as granite, nor do I wish to be understood as claiming that the Kreodone block will last longer than the granite block, but I do claim that under the same conditions of traffic, because of the solid unyielding character of the granite, that the Kreodone block will remain a good pavement very much longer than the granite.

A feature which is worthy of mention is the ease with which this pavement can be repaired. In many cases, where telephone companies and other companies had to cut through the pavement, the replacing of the pavement has been done so skilfully that it is hardly noticeable where the pavement was removed.

Tests by city authorities for this or any other treated wooden block pavement should be made with the treated block as it is prepared for the street. It should be ascertained whether it expands and contracts under heat and cold, whether it absorbs moisture and expands, whether the oil is a fixed oil, and the gravity of the block taken to see if it has had the treatment called for in the specifications. The chemical tests necessary to be made are such as will show that the oil contains no ingredients inconsistent with true creosote oil products.

Kreodone block as a result of experience in manufacture and public use, is now a street material which, besides possessing the conceded good points of wood, is wholly indifferent to wet, dry, heat or cold.

President Rust: Mr. Merrit, Park Commissioner, wishes to leave, so we will hear his paper on "The Park System of the City" next.

THE PARK SYSTEM OF INDIANAPOLIS.

In this little talk about the parks of Indianapolis I shall not try to convince you that we have the best system of parks in the country, or the most beautiful scenery in them; but we have a fair share of beauty and a good system that is steadily adding new beauties, all of which speak for themselves.

I think it better to study our mistakes.

The park history ,of Indianapolis is only 36 years old; and for the first 20 years the development was very slow because those that were appointed to care for them were usually appointed for political reasons, and were changed so frequently with the changing administration that they could not be expected to do much efficient work for the parks and attend to the needs of the political machine of which they were a part.

In 1867 work was begun on the Military reservation to improve it. Fifteen hundred dollars was raised by private subscription from citizens living in the neighborhood, and $1,000 was appropriated by the city.

This sum of $2,500 was expended by the citizens who had contributed to the fund, and with careful management was sufficient to grade the surface of the park, to lay out and grade the drives and walks, purchase and plant 1,000 native forest trees, and to furnish the Central Pool with its Rockery, to provide a very small fountain, and to seed the grounds with blue grass.

For six or seven years the care of the park remained in the hands of those who had contributed to the fund for its improvement, and the enthusiasm that had prompted the first steps in the improvement was sufficiently continuous to insure proper care of the park and a healthy growth of a love for its beauties, even the children taking an active interest in its development and care, and during that period it was an ideal spot for the children and thousands of the little folk enjoyed it.

But as time passed, circumstances deprived the park of the care of those who had so successfully developed it, and its care was left entirely in the hands of a custodian appointed by the council, as dictated by alternating political parties (first mistake) with the usual result that the physical care of the park was neglected, allowing it to become shabby in appearance while its moral atmosphere became so corrupt that decent people shunned it and parents felt compelled to keep their children away.

About 1873 the city council bought the 97 acres known as Garfield Park, paying for it $109.500 (another mistake).

From 1873 to 1894 Garfield Park was little more than a political football, used alternately by each political party to pay its campaign debts (mistakes), one party hauling in dirt to fill the low ground along Pleasant Run and the other digging it out again to make a lake; thus doing and undoing because there was no head or system. This continued until 1895 when the non-partisan Board of Park Commissioners created by the legislature took charge of Garfield and began a system of improvement that has gone steadily forward ever since that time, giving the city a beautiful park.

In 1895 the Board of Park Commissioners began the plans for a comprehensive system of parks and boulevards, extending from Washington Street along the east side of White River to the mouth of Fall Creek, thence northwardly, taking in both banks of Fall Creek up to the State Fair Grounds. This tract had many owners and was largely used as a dumping ground for the trash and street sweepings of the city (which seems to be the common use of banks of streams in all cities).

If that tract of land had been secured it would have converted ugliness into beauty, unhealthfulness into healthful pleasure. The ground is easily accessible to all the city, but only a small portion of the many owners of this tract met the Board in a spirit of fairness as to the value of their ground, while some seemed to feel that it was a favorable opportunity to force the city to pay them a large price for property hitherto considered of little value.

This spirit so enhanced the price of this tract that the amount to be assessed on adjoining property as benefits was so large that it aroused an opposition to the scheme which finally took it into the courts, where the law creating the Board of Park Commissioners was declared unconstitutional on a verbal technicality.

The abandonment of this tract was a very serious mistake that never can be wholly corrected.

The Board of Park Commissioners having been courted out of existence, the work of securing ground for a large park was taken up by the Board of Public Works with the result that Riverside and Brookside Parks were bought. Both of these tracts have elements of beauty that make them well fitted for parks, but they are too far from the people, and to reach them one must pass through or near the unsightly dumps of trash before referred to.

Time, however, will bring the city to these parks, and twenty-five years will see those vacant spaces occupied and the objectionable accumulations entirely removed or destroyed.

The Board of Park Commissioners stands ready to assist in that good work whenever they are given a chance and have the support of the public.

In the movement for boulevards along Fall Creek and Pleasant Run, an opportunity is offered to eliminate many of these unsightly places and out of ugliness bring beauty. But the appropriation made by the council is so inadequate that unless the citizens of that part of the city supplement the sum by a large liberality, only a beginning can be made. I am very pleased to know that some of these citizens have already shown their appreciation of the importance of these boulevards by making liberal donations, and if all who will be benefited will show the same liberal spirit much good will be accomplished.

This movement should be extended until the banks of all streams inside the city are controlled by the Board of Park Commissioners and boulevards constructed to all the large parks.

In 1900 the Legislature re-enacted the law creating a bi-partisan Board of Park Commissioners, and since this Board was organized the work of park improvement under the supervision of our competent superintendent, J. Clyde Power, has gone steadily forward, each year adding new beauties to our many parks.

My experience and observations demonstrate the importance of a comprehensive law under which a bi-partisan Board shall manage the parks on strictly business principles.

A Board that will allow neither political nor personal reasons to control in selecting men to fill any positions in connection with park work; fitness for the work being the sole consideration. Having secured good men, few changes should be made in any part of the work. Even common laborers are more efficient after they have had experience and should not be changed except for cause.

A Board that will work in harmony with other departments of the city government, particularly the police department, as efficient policing is very important. In this respect we have been very fortunate.

The woman is another very important factor in park life; wherever children are, there should be a good and competent woman to care for them and *assist* them in their play. One such woman can do more to preserve a pure moral tone in the parks than any other available force, and unless it is maintained the fewer parks we have the better.

Politics having been eliminated, we are now making rapid strides to have parks in keeping with our beautiful city.

The Board of Park Commissioners and the superintendent fully realize the facts that the parks should be for recreation.

This picture before you is from the children's playground in Military Park which was first started by private enterprise in 1889 for the purpose of redeeming the park from the evils into which it had fallen, and the result fully met the expectations of its originator. The moral tone of the park was so improved that mothers brought their children there because it was the safest place for them. It is probably the oldest playground of its kind in the country. Hundreds of inquiries have been received from this and foreign countries asking for the details of its origin and management.

The central thought in the beginning was to have trained kindergartners always on the ground to *assist* the children in their plays.

Eleven years of the existence of this playground so fully demonstrated the usefulness and importance of the presence of suitable women in the parks that the Board readily and gladly assumed all future expenses of this playground and established a similar one at Garfled Park, and without doubt the work will be extended to other sections when needed.

Here we have a baseball game at Riverside Park, which, together with football games, furnish a good outlet for the surplus energy of boyhood and early manhood.

We also have our golfers and our links at Riverside and are said to be equal to any in the country and hundreds enjoy them.

In this picture we are with picnickers at Garfield Park, an almost daily scene in all our parks during the summer season. The number who enjoy the parks in this way amounting to many thousands.

Mr. Brown, Indianapolis: Mr. Merritt's modesty prevents him from saying that he was the resident in the neighborhood through whose efforts this work was done.

President Rust: The next paper is by Mr. F. A. W. Davis, General Manager of the Indianapolis Waterworks system.

Mr. Davis: I feel highly honored in being invited to address your association. I was told that this is a very technical body. My paper this evening is something of a kaleidoscope. I trust you will all find something interesting and pleasing in it.

THE INDIANAPOLIS WATERWORKS AND MATTERS PERTAINING TO WATERWORKS IN GENERAL.

BY F. A. W. DAVIS.

On January 27, 1836, the Legislature of this State passed an internal improvement act. Section 4 of this act provided for the construction of the Indiana Central Canal. Appropriation of $3,500,000 was made. The canal from the City of Indianapolis to Broad Ripple was constructed and put in use in the year 1839. January 30, 1851, the canal was sold to

Gould & Jackson who conveyed the same to the Manufacturing Hydraulic Water Works Company. May 1, 1870, the canal was transferred to the Water Works Company of Indianapolis. April 21, 1881, the Water Works Company, including the canal, was conveyed to Hamilton, Woodruff & Dennison, who conveyed the same to the present Indianapolis Water Company. At the time of transfer the Indianapolis Water Company had about 52 miles of mains and about 9,000,000 gallons in 24 hours pumping capacity. The present works consists of a little over 250 miles of mains, and 1,990 fire hydrants. Present pumping capacity 57,000,000 gallons in 24 hours, and under construction by the Rarig Engineering Company, from plans furnished by L. K. Davis, one 30,000,000 gallon triple expansion high duty engine. Attachments in service, 14,250. The increase in the twenty-two years is nearly 200 miles of mains and an increased capacity of pumping machinery of 78,000,000 gallons.

The buildings of the company consist of four pumping rooms and two boiler rooms. Two of the buildings erected are handsome pumping stations, and surrounding them are 252 acres of ground which is being converted into a park.

The 20,000,000 triple expension engine has broken the world's record for high duty engines of its class, and is certainly a beautiful piece of machinery.

The engines of the Water Company do not have the advantages that an engine pumping into a reservoir or into a standpipe has in making a record for duty, for the load upon ours is constantly changing.

The canal supplies the Water Company with about 1,000 horse-power for its water-power pumps, besides supplying mills and factories located along its banks with water for various purposes.

The growth of the Water Company to many may not seem great, but when it is remembered that there are three veins of water to compete with and the supply in the beginning of the Water Works Company not satisfactory, the growth will appear to be quite remarkable.

To get a cool drink of wholesome water from a well and not be dependent upon a corporation of either city or private, was much to the liking of many. At one time in our history the State of Indiana had the fewest water works to the number of inhabitants of any State in the Union except North Carolina.

The water of the three veins mentioned varies in character somewhat. The first vein, from 18 to 40 feet in depth, having no iron; the next vein passing through a layer of blue clay at a depth from 60 to 90 feet, showing trace of iron; the third vein, if it may so be termed, found in rock strata, being quite highly impregnate with iron and distinct odor of sulphur.

The water at the present time is obtained from 30 wells, 25 being 10 inches, and 5, 8 inches in diameter. They are of an average depth of 320 feet. Two of the wells were drilled to a depth of 510 feet, but they showed no increase of head and a decided increase of sulphur. The water when brought up from the wells is very beautiful, but in a few hours the iron begins to precipitate and gives the water a milky appearance. After the iron has been precipitated the water becomes bright and clear again, and there is a brown powder left on the bottom of the bottle. The wells are on an average about 220 feet in rock, the drill sometimes striking seams between layers of rock as much as 18 inches. Only in one well did the drill show a perpendicular opening in the rock. The chemical analysis shows other variations in the water than that mentioned. However, both analysis and bacterial examination of the water shows it to be high class. The three veins showed the water to be good at one time, but all hard water. The growth of the city and the digging of cesspools in the gravelly soil has contaminated very many of the first and second vein wells, besides the quantity of water in all well supply is growing less. When our first well was drilled it overflowed the water in the river with an 8-foot head and was a beautiful sight, but at present the water stands 33 feet below the 8-foot head. The water from the wells is lifted by air, a very expensive and wasteful method and not recommended. The temperature of the air produced by the compression increases its volume, and when the air comes in contact with the water the volume is reduced and consequently the lifting power of the air is reduced accordingly.

The company received its authority by Legislative Act of 1865, which authorized it to construct water works and to make charges, rates, rules and regulations for the government of the company.

RATES.

The flat rates of the Water Company are among the lowest in the country, being $3.00 per annum for a two-room house, $4.00 for three rooms, $5.00 for a six-room house; $1.00 for each additional room; bath $3.00, closet $3.00 per annum. This charge includes laundry tubs, wash-stand in all the rooms, and kitchen sink.

Sprinkling rates, in connection with family use, are low, depending upon the street. It includes water for garden and lawns, and washing of windows, porches and sidewalks.

METER RATES.

The highest meter rate was originally 40 cents a thousand cubic feet, the lowest 15 cents. It is now 18 cents, the highest, and 4½ cents, the lowest, being a graduated scale of charges, and so arranged that though a man may receive more water and pay a less price, the company will receive an additional sum of money. In other words, there is nothing in the scale to encourage any one to waste the water in order to get low rates.

In this connection I am reminded of one city that has a minimum rate of $6.00: For the first 30,000 gallons, $1.75, and 2¼ cents thereafter per 1,000 gallons. At the rates mentioned, a consumer is entitled to 219,000 gallons of water per annum for $6.00, being equivalent to 600 gallons a day, equal to nearly 10 hogsheads of water, and to 5,013 pounds in weight per diem. It may be argued that a man will not use 600 gallons of water a day, but that does not alter the proposition that for the payment of $6.00 he is entitled to 219,000 gallons of water per annum. If consumers drew the quantity of water they are entitled to per diem, I question very much the ability of the works to furnish it during certain hours.

This rate is a stumbling block to many municipally owned water plants as well as private plants, and it is not what would be termed a sound business proposition.

In this connection it is proper for me to say that the value of water is steadily increasing in most parts of the country by reason of the cost of filtration and the scarcity of the supply.

At the present time the Water Company has a contract with the city in which the city agrees to pay $45.00 per hydrant.

In addition to furnishing fire pressure, the company furnishes city water free of charge for a fountain in each of the parks: "Also water for each engine house, each reel house, each station house, city dispensary, thirty thousand gallons of water at each per month, if so much shall be required; also water for the police headquarters, four hundred thousand gallons per month, if so much shall be required; also water necessary for the purpose of flushing and cleaning public sewers and improved streets and the filling of public cisterns within the reach of the line of water pipe; also water for public latrines when constructed under streets; also water for Tomlinson Hall and market houses, five hundred thousand gallons per month, in the aggregate at said hall and market houses, if so much shall be required; also water for city hospital, six hundred thousand gallons per month if so much shall be required; also water for public baths, when established, one hundred thousand gallons per day, if so much be required; also water for sprinkling lawns and roadways in all public parks, five million gallons per month, in the aggregate, if so much shall be required. Water from the canal to supply a four-inch pipe for the lily pond in Riverside Park, the pipe for such four-inch line to be furnished, laid and maintained by the city, and the water drawn there through for said pond not to be computed as a part of the said five million gallons above mentioned. The members of the fire department may, without cost to the city, use water from the fire hydrants or plugs to sprinkle the streets immediately adjacent to the several engine houses, and the hose reel houses: provided ordinary sprinkling nozzles are used for that purpose."

The hydrants are put in and maintained by the company at its expense. The company furnishes a man, at its own expense, to attend all the fires. He sees that the hydrants are properly opened, and also sees that they are put in repair promptly, if broken. The city has no responsibility for any accident that may occur to him in going to and from, or in attending, fires.

TAXES.

The company pays of its gross receipts a fraction over 8 per cent. for taxes, so that out of every hundred dollars received $8.00 is paid for taxes.

EMPLOYEES OF THE COMPANY.

The company takes deep interest in its employees. It requires them to be sober, industrious and temperate. Some of them have been with the company between twenty and thirty years. Vacation is allowed them during the year, and during sickness their wages are paid them. They are encouraged to learn all that pertains to their own particular position and water works in general. The more intelligent they become the more valuable they are to the company. They are also encouraged to own their own homes, and the company has constant anxiety for their welfare and that of their families. This is in contrast with municipal ownership, where men know that they have often received their appointment through political influence, and may be changed when a change in political situation occurs. Under the circumstances they have great anxiety to retain their positions and cannot put forth their best effort and thought for the interest of the water department, and often they are found planning, soon after being installed, how they will retain their position. On the other hand, the Water Company plans how it may keep good men.

It must be kept in mind that science and mechanics are making such rapid strides these days that knowledge of to-day may be rubbish to-morrow, and a man must not only have his mind bent to his duties but he must be studious and wide awake to changes and improvements that he may be able to avail himself of them in his work.

POLITICS.

The Water Company never questions a man's politics nor his religion, and has respect for his views whether he be a Democrat or Republican, and he may be either without fearing that his position is in jeopardy because he may be a Democrat or a Republican.

The mains laid by the company are considered by many as being excessive in weight, and manufacturers of machinery have claimed that our specifications for machinery are heavier than required, but it must be borne in mind that we furnish direct pressure for fires (engines being rarely used) and the machinery must be massive and strong.

The cost of a system built for fire protection is greatly in excess of a system built for ordinary domestic supply. Mr. Fanning, an engineer of high authority, estimates that a Water Works Plant of eighty miles, built for domestic use, would cost $333,333, and where built for fire protection and domestic use with 960 hydrants, would cost $1,000,000. Operating and fixed charges $812 per miles greater for combined plant, making $67.70 actual annual cost per hydrant.

FILTER PLANT.

The company has now under consideration a handsome laboratory and filter beds for slow sand filtration. The bottom of the beds is constructed of concrete, and on top of this is laid tile with perforated tops, through which the water runs to the collecting galleries after percolating through four feet of sand and gravel. The water flows to the clear water basins and from them into the conduit line, thence to receiving well, from which the pumps take the water through their suction pipe. The wash gallery is separate from the collecting galleries and is to be used for draining when the beds are first filled with water. The beds are three in number, are 200 feet wide by 350 feet long, with two clear water basins, 70 by 350 feet, storage capacity of each clear water basin, 2,500,000 gallons. On account of free drainage, there being 2,000,000—5/16 holes in each bed, and the free access of the water to the galleries, we estimate that we will get 5,000,000 gallons per acre of excellent water. We are confident from the form of construction that our beds will be an improvement over the older form of filtration beds. The construction work is being done by the United States Sand Filtration Co., from plans furnished by that company.

APPRAISALS.

I have been asked many times what is a fair method of appraising water works.

It is extremely difficult for an engineer to determine the value of a water plant located in any city by simply taking the miles of mains and the size, the valves, hydrants, machinery and water supply. There is no question that these items enter largely into the value of the waterworks plant; they are the principal items for estimating values, but there is also that intangible value which accrues during long years of toil and labor, that which is wrought into the development of the plant, not physical, as the mains, machinery and appurtenances. Not least of these intangible values is the education of the people to become users of the public water supply. Even to this very day there are in this city people that eschew the luxuries and conveniences a public water supply affords them. Education costs time and money, no matter in what line it is attempted. So this education is an item real as any I have mentioned, and must not be lost sight of in trying to find the true value of waterworks plants. The cast iron mains are practically indestructible. Machinery if kept up and kindly treated will last a life time if the business does not outgrow its capacity. So that the thoughtful and experienced man who has had the development of a plant will be mindful of the value of the business developed and give due credit.

Again, I am asked what is fair for hydrant rental. I can only say it must be sufficient to justify the establishing of the plant which is a public necessity and specifically for the benefit of the public. The number of hydrants to the mile should have some weight in fixing the price. Then another consideration is the kind of a plant that is to be put in. If the machinery is light and small, if the pipes are mainly 3 and 4 inch, the buildings poor, then such a plant should not receive a hydrant rental that a good plant would be entitled to. Hydrant rental is a definite way of expressing what should be paid for fire protection, and it might be well if cities generally adopted some rate per hydrant to be paid the Water Department for the protection afforded to property. Supplying water for domestic and commercial uses and fire protection are distinct propositions.

PRIVATE RATES.

The question of rates is continually presented, and the true solution of rates cannot be arrived at by what another city charges. Comparisons are undoubtedly a guide, but the guide must be studied with care and everything considered to arrive at a fair rate, for the conditions in cities differ greatly. Rates for fire protection and private and commercial uses must be sufficient to justify building the works and their maintenance.

If it is a franchise company, rates should be such as to furnish some remuneration for the capital invested (however, not upon an over-issue of stock and bonds), payment of taxes, interest and operating expenses. Besides the franchise should be so guarded that the city cannot by any means render a waterworks worthless by paralleling the system or getting a plant at less than actual value. Man's inhumanity to man has been more than once exemplified in connection with waterworks systems.

A city with waterworks plant worth say $9,000,000 and bonded debt of $3,000,000, leaving $6,000,000 to do business on, ought to furnish water at a less rate than a city with a waterworks debt almost equal to the value of the plant. At least this is the way we reason, but facts do not bear out our reasoning, and we must inquire into the management of the works for explanation. This free capital is not often considered. Sometimes it will be found if the municipal works were sold and the free capital loaned at 4½ or 5 per cent. interest, and the plant taxed as other property, that the city could pay $40 or $45 per hydrant and save a large sum. This is the sordid side, but this fact should not militate against municipal ownership, if it is the desire of the citizens.

STREAM POLLUTION.

There is hardly a large city in the Union, whether it be located upon a river or a lake, but that must face the question of a pure supply of water for their respective inhabitants. The water of great lakes is being polluted near the shore. The cities bordering on the lakes have extended tunnels at an immense cost far out into the lakes, and yet are not able to obtain a constant supply of unpolluted water. In fact the growth of population is so rapid and so great that the sewage is tainting nearly every source of water supply. When it is not sewage it is equally as bad pollution from strawboard works, tan yards, dye houses, and various other forms of pollution.

Knowing as you do that upon a pure and wholesome water supply depends the life and happiness of a people, it would seem that every city and every private corporation owning waterworks should in every way use their utmost efforts to have stream pollution prohibited.

There is nothing more exquisitely beautiful than a bright, wholesome, sparkling stream. Not only is the beautiful stream a source of enjoyment for human beings, but it is necessary for the cattle of the field, the birds of the air, and for the fishes that swim in it; and nothing more wretched can be imagined than to have a beautiful stream turned into a reeking mass of filth, filling the air with vile odors and causing sickness and death along its borders.

People are more tolerant of a supply of bad water furnished by the municipal owned plant than one owned by a corporation. This should not be so. Neither should a city tolerate stream polluting, even if it does compel factories to shut down. Much factory waste is being turned into value, and so cities should turn their sewage waste into value, and streams now polluted would thereby become a joy forever.

ELECTROLYSIS.

There is an old proverb which says, "For a web begun God sends thread."

Imagine for a moment Benjamin Franklin standing in a field with kite up in the air and in his hand a silk handkerchief and his Leyden jar; and then call to mind the mighty generators at work the world over driving machinery, street cars, and doing other beneficient work, besides furnishing millions and millions of lights, and you have a panorama of a most wonderful development along electric lines. While these currents are doing great work and much that is beneficient. when under control, yet when not they create great destruction—sometimes with a flash and then subtle, as when destroying underground iron construction. There is no longer any doubt as to the destructiveness of escaping currents from street car rails, and it is in this form that you must deal with it in a vigorous manner if you would save millions of dollars worth of property. In this city 8 inch wrought iron mains have been destroyed in a short time. Private services, both lead and iron, have been destroyed within six months after renewal. On some of the mains the current is so great that they become very warm and dangerous to workmen. That these conditions should be continued when there is a remedy is an outrage and an invasion of the rights of others. That legislative or administrative bodies of cities should grant a franchise to a corporation that will use a destructive element for power, when it is known to a certaintv that it will destroy the waterworks mains, shows an utter disregard for the property of the city, which is amazing. Much litigation is pending in nearly every state to get relief from this wrong. but it is a slow and costly process. The prevention of destruction by stray currents from rails is complete insulation of the wires. and the remedy should be applied by the owners of roads using electric currents for power and at their expense.

MACHINERY.

The development in machinery at this time is towards rotary motion, and steam turbines and gas turbines may soon be in evidence in pumping water. No matter how the machinery may change, the product never. It will be water still. Even when this mortality has put on immortality we are to be delighted with a "river of water of life bright as crystal." provided we have run our levels in the right direction.

"The Sewer System" was described in brief by Charles Carroll Brown, former City Engineer with the aid a map of the system.

DESCRIPTION OF THE STREET RAILWAY SYSTEM, INCLUDING INTERURBAN TERMINAL PLANTS.

THOMAS B. MCMATH, ENGINEER INDIANAPOLIS TRACTION AND TERMINAL CO.

The street railway system of Indianapolis had its beginning in an act of the legislature of the state approved June 4, 1861, which provided for the incorporation of street railway companies.

The Citizens' Street Railway Company incorporated under the act in January, 1864, with a capital stock of $100.000, and construction followed and transportation facilities were provided for a district of seven square miles. By the year 1886 there were twenty-one and a half miles of track in operation.

The street railway of Indianapolis has always been developed as a system of lines radiating from the business center. The intersection of Illinois and Washington streets being the radiating point. The lines are operated so that in making a round trip every car in the city passes this point during the trip. Lines having a short time interval between cars make a loop in the vicinity of Illinois and Washington streets; other lines with a greater interval are operated as double lines, that is, the car starting from an outer terminal passes this common point on its way to a terminal at some other outer point in the city. This point of intersection is the place of general transfer.

Mr. Hugh J. McGowan came to this city in 1898 and organized what was known as the Indianapolis Street Railway Company.

The equipment consisted of 100 miles of track and a plant capable of furnishing 2,000 horse power, and operating 200 cars.

The Indianapolis street railway franchise is a contract with the City of Indianapolis authorized by an act of the State Legislature. The prominent features of the contract between the City of Indianapolis and the Indianapolis Street Railway Company were:

1. The rates of fare—six tickets for 25 cents and 25 for $1, that is four-cent fare, with the privilege of a tranfer permitting the passenger a continuous ride on any other line on the system.

2. The giving to Board of Public Works a general supervision over the execution of the contract.

3. The obligation to pave and maintain the space between the tracks and a space of 18 inches outside of the outside rails of all tracks.

4. The service to be provided to be efficient and first-class.

The obligation to pave the tracks has for the past four years required an annual expenditure of $300,000, and is in charge of a special department under the civil engineer. The kinds of paving have been asphalt, brick, creosoted wood block, macadam, and gravel. Our experience in this department has shown brick to be the most satisfactory. The streets of the city are generally wide with ample room for the wagon traffic outside of the tracks, hence asphalt laid in the track has never had sufficient work to keep it elastic, and therefore the pavement has become brittle, and vibration due to the cars has cracked it and loosened it from the concrete base. We have found it advisable to lay brick stretchers along the rails to overcome this difficulty. Creosoted wood blocks after three or four years begins to absorb moisture—swelling follows, resulting in the destruction of the track, it being utterly impossible to maintain the correct gauge, material changes in the gauge taking place in a few hours Brick makes a good appearing street and under the traffic conditions existing in Indianapolis is very satisfactory.

The former standard of track construction was a nine-inch girder rail of Philadelphia type, and weighing ninety-three pounds to the yard, on ties spaced two feet apart, with gravel ballast, or on ties spaced eight feet apart, and a concrete beam twenty inches wide and extending nine inches under the rail.

The Indianapolis Street Railway Company upon taking possession of the Citizens' Railway Company began the task of rebuilding and modernizing the property. The capacity of the power house has been increased three fold, making 6,000 horse power. The overhead wire system has been entirely rebuilt. Forty miles of track has been rebuilt and twenty miles of extensions added. The old rolling stock of short cars, termed by the people of Indianapolis, "dinkeys," has been discarded. The rolling stock now on the streets of Indianapolis is all less than four years old. We think that we have in our large cross seat double truck car the best city passenger car in this country. The people of Indianapolis have, in five years, changed from speaking of their car service with supreme contempt to actually bragging that it is the finest, without exception, in the country.

In 1900 the Indianapolis Street Railway Company provided terminal facilities for the first interurban line, the Greenwood. This was quickly followed by the Greenfield line and the Union Traction Company. The large, heavy cars of the Union Traction Company demonstrated the necessity of special track construction to accommodate interurban traffic.

Interurban cars to run at a fair rate of speed must use wheels with a larger flange than formerly used for city traffic, and of necessity the cars are larger and heavier. The only rail adapted for this traffic in city streets is a high "T" rail. The College Avenue line in this city, on which the Union Traction Company cars operate, was rebuilt last year with a seven-inch Shanghai "T" rail on ties spaced two feet apart, and ballasted with six inches of concrete under the ties, the concrete being carried up to within five inches of the top of the rail, the average thickness of the concrete being fourteen inches, the street surface being vitrified brick on a sand cushion. A special shaped nose brick was used adjoining the rail to form a groove for the wheel flange.

The rapid development of the interurban lines brought with it the necessity for proper terminal facilities. By joint agreement between the City of Indianapolis and the interurban companies of 1902, and the Indianapolis Street Railway Company, the Indianapolis Traction and Terminal Company was organized, and in August, 1902, entered into contract with the City of Indianapolis to provide terminal facilities for all interurban lines, with authority to secure by lease, or purchase, the Indianapolis Street Railway Company. In January, 1903, the Traction & Terminal Company secured a lease of the Indianapolis Street Railway Company. The contract of the Traction & Terminal Company provides for the construction of a. terminal station for passengers, a freight station, and the necessary tracks and connections thereto.

The congested condition of traffic on Pennsvlvania, Washington and Illinois streets, which comprise the retail district of the city, rendered it necessary to construct tracks for interurban traffic to avoid these congested streets in reaching the station. Ground was secured for the Interurban station by the purchase of the southeast quarter of the block bounded by Illinois Street, Ohio and Market Streets, and Capital Avenue. The general project of the interurban station was to occupy the Illinois Street frontage of the quarter block with a fine nine-story office building, through which should be the entrance to the train shed, and which should contain waiting rooms, and all possible conveniences for the traveling public, the remainder of the property to be occupied by the train shed.

The tracks will enter the train shed from Market Street, and will be nine in number through the station, and converging into two tracks before reaching the exit at Ohio Street.

Provision is made to reach the station by the construction of tracks with the proper connecting curves, on Delaware Street, Ohio Street, Capitol Avenue and Maryland Street. These streets provide therefore a rectangular loop enclosing twelve city blocks, which encloses the retail business district. Interurban lines upon reaching this loop may proceed to the station by the most direct route, or in case of blockades, reach the station by going around this loop in the opposite direction.

It is sufficient to say, in describing this station, that it was designed by D. H. Burnham & Company, of Chicago, and is being erected under their supervision. It will cost about one and one-half million dollars. No feature that could add to the convenience or comfort of the traveling public, or other occupants of the building, has been omitted.

The construction of the loop by which the interurban cars will reach the station will be of the most permanent character. A special rail has been provided, seven inches in height, weighing ninety-one pounds to the yard. This rail will be laid on a heavy concrete beam, and anchored to the beam at intervals of four feet. At practically every street intersection along this loop are contemplated curves, and connecting tracks made of the heaviest construction. The contract for furnishing these curves and the special work has been let to the Lorain Steel Company. Eight of these intersections will cost $14,000 each, which gives some idea of the quality and magnitude of the work to be done. New work is now being installed at Pennsylvania and Washington Streets, and is a good example of the intricate work required.

An interurban railway company entering Indianapolis must make a contract with the city, through the Board of Public Works. The existing contracts provide for a five-cent fare on interurbans inside the city limits, without transfer; also a description as to routes to be taken to the station, permit carrying mail, baggage, package freight, merchandise—to be unloaded only in a station; provide that freight rates shall not exceed those charged by common carriers. nor be less than 80 per cent. of steam railway freight schedules and pay a car tax of 1 per cent. for each round trip per car, inside the city limits.

The Traction & Terminal Company's contract provides that it shall pay a car tax on interurban cars for the first eleven years of 4 cents per car, round trip, for all interurbans, four-fifths of whose route in the city is on its tracks, and which enters the terminal station. The next ten years this tax will be 6 cents per round trip and 9 cents for the balance of the life of the present contract.

Indianapolis is a pioneer in the solution of the problem of terminal facilities for interurban companies. We feel that in providing this union interurban station, located in the business district of the city, we have solved this problem, and will unload our passengers where they may transact their business, within one block of the State Capitol, the Soldiers' Monument, and in close proximity to the markets and the railway station.

The building will be one which may be displayed to visitors with pride, not only for the architectural beauty, but as the first union interurban station.

MR. ELDRIDGE then read the following paper:

THE CENTRAL HEATING PLANTS OF INDIANAPOLIS.

BY W. K. ELDRIDGE, C. E., INDIANAPOLIS, IND.

Central station heating plants are so rapidly growing in popularity, that they can not be installed fast enough to keep pace with the demand. Particularly is this true in Central and Eastern Indiana, where the conveniences of heating by natural gas have instilled in the people a strong aversion to a return to coal handling and firing for their stores, offices and dwellings, fast being forced upon them by the failure of the gas fields. In conjunction with the production of light and power (the exhaust steam from which was in former times largely allowed to go to waste) a revenue is derived from this erstwhile waste product from rates easily within the reach of consumers in even moderate circumstances. It is not strange then that central station heating should be a most attractive consideration to both producers and consumers; and in the case of municipal electric light works, might often transform a taxing proposition into a self-supporting one. Such plants are beginning to have a great vogue in the smaller cities of the state, the writer and his partner (but one firm among many), having been connected with the installation of systems in Newcastle, Peru, Connersville, Terre Haute, Fort Wayne, Lafayette, and Bloomington, Ind., Mt. Vernon, Ill., and Springfield, Ohio, within the space of a single year. All these plants are operated in conjunction with electric lighting and in two cases the production of artificial gas, also.

Indianapolis was early in the field with a company named the "Home Heating and Lighting Co.," which, in the year 1899, obtained a franchise from the city for an area of about 2¾ sq. miles in the north part of the city surrounding the location of their works on the corner of Alabama and 16th Streets. This plant is designed to furnish hot water and electric light, with wires on poles, and now has about ——— miles of double piping and ——— miles of pole line. The total radiation in service is now about 325,000 sq. ft., taxing the plant to its fullest capacity in the severest weather, so that large additions are being considered. The boiler capacity is ——— rated H. P. and the lighting capacity ——— K. W. The service is almost wholly residential, the water being heated by the exhaust steam, re-enforced with live steam automatically, whenever necessary, and is circulated through the mains and radiators by means of powerful pumps. This plant is the largest for hot water heating yet installed in the United States.

As exemplifying how factories and other enterprises producing power may thus utilize their waste steam for revenue, the writer will instance the Century Building, corner of Pennsylvania and Maryland Streets (John W. and Edward Schmidt, owners), with the erection of which the writer had the honor of being connected. This building of seven stories and basement covers an area of 135 by 195 feet, affording a net rental area on each floor of about 20,000 sq. ft. On each floor are from two to a dozen tenants engaged in manufacturing, and furnished with heat, light, water and power from a steam plant in the basement. The latter consist of two Stirling boilers of 200 H. P. each, to which is now being added one more of 250 H. P.; two engine-dynamos of 50 K. W. and 80 K. W. respectively, to which is now being added a new Corliss of almost 200 K. W. capacity. The heating system of the building is by exhaust steam with vacuum return: and it being found that much more steam was required for power than necessary to perform the heating service, steam pipes were run in several directions to many of the neighboring buildings, including a four-story office building covering 14,000 sq. ft. of ground, abolishing at least a dozen smoky chimneys in the heart of our business district, about which there had been much complaint. This last feature is not one of the least advantages connected with a central heating system.

One of our citizens who has a large rental property in the north part of the city, put in a central heating station for his cluster of houses, and has applied for a franchise enabling him also to take on the neighboring houses in the same square.

The most important enterprise of this nature in the city is the new Merchants' Heat and Light Co., which has seen one winter of service. Their franchise covers the so-called original mile square of the city, of which the exact center is the Soldiers' Monument in the circle, and gives them access to the main wholesale and retail centers, public buildings and other business territory. The writer and partner have the honor of being also connected with the installation of this enterprise. The power house is located in South New Jersey Street, one-half square south from Washington Street, from which is distributed electric light and power, and direct steam heat on a single pipe system. The building comprises an engine room, 30x90 feet, with basement for heaters, condensers, piping, etc., and a boiler room, 45x90 feet, and is so located on the ground that the capacity of each room may be doubled by future extensions. In the boiler room is installed a battery of seven Wickes upright water-tubular boilers with Roney stokers, giving an aggregate of 1,750 H. P., working up to 2,100 H. P. The future addition to the boiler room will afford space for seven more boilers of the same type, facing the present battery, and it is the intention at that time to install overhead storage bins between the two batteries for the coal, with spouts leading to the hoppers of the stokers. A railroad siding runs along the south side of the building. A tunnel under the ash-pits (not yet in use) is intended to provide space for ash handling machinery in the future.

The products of combustion are discharged on the down-draft principle into a smoke duct 6x9 feet in area running along the floor back of the boilers, and turning into a smoke tunnel along the north wall of the room, and running underground through the back yard to the stack, which is circular, 9 feet in diameter and 165 feet high from the ground, built of hollow radial blocks. Adjoining the stack is a cooling tower for the condenser water, 13 feet diameter and 32 feet high. In the engine room are four engine-dynamos of 1,200 K. W. total capacity, furnishing electric current at 230 volts, 3-wire system.

The street system consists of the steam mains, electric wire conduits, and a compressed air pipe.

The principal steam main leaves the house 20 inches in diameter, and runs west in Washington Street for about 2.800 feet to the first reduction. Altogether about 16,000 feet of steam piping, and 150,000 feet of conduit have been laid to this date, and the work still goes on. The total radiation expected to be supplied this winter amounts to 175,000 sq. ft.

Expansion joints, accessible from manholes, are placed in the steam mains about 150 feet apart, with anchorages midway; all steam mains are enclosed in several thicknesses of insulation and boxed in . A compressed air pipe 3 inches in diameter is run in the same trench, the compressed air being for the purpose of operating the shut-off valves in the various buildings supplied. In each building are placed one or more thermostats, by the action of which the compressed air is admitted to or released from the shut-off valves. Not only is the temperature of the building thus regulated, but a material saving of steam is effected.

The water of condensation in the various buildings is utilized in boxed coils in the basement for indirect radiation, the warmed air passing through registers in the floor above. By this means several desirable results are obtained. The room heated derives the benefit of a certain amount of fresh, warmed air, in addition to the direct steam heat, and an equivalent amount of steam is saved; the net result to the company being more economical than if the water were returned to the station, which would require quite a complicated system of piping, vacuum pumps, etc., with added risk of getting out of order. Wherever it is desired, the hot water is further used as water, as in hotels, etc., with addition to revenue; otherwise runs off into the sewers. Low points in the street mains are traped into the sewers.

In the same trench, to one side of and a little above the steam main boxing, are laid the electric wire conduits, leaving the power house 20 in number, of which 15 are at present occupied with cables of a total capacity of 5,300 amperes at 115 volts pressure. The construction and means of access are much after the usual style for such work.

Nearly all the trenching has been cut in sheet asphalt and the restoration of the street surface will doubtless be of interest to many of the members of this convention.

The incorporators of this project are many among the most solid and prosperous merchants of the city, the first idea having been almost of a co-operative nature for their own relief and service, but soon extended to its present magnitude. A sincere attempt has been made by the builder, Mr. William H. Schott, to have the entire outfit up-to-date in every particular, and the whole has been installed in a very creditable and efficient manner, to the unqualified satisfaction of the company.

FOURTH SESSION.

The fourth session was called to order by President Rust at 9:30 a. m., Thursday, October 22d.

PRESIDENT RUST: The first order of business will be the report of the committees that were appointed yesterday. the committee to select the next place of meeting and the Committee on Nominations.

I have here some letters from St. Louis that did not reach me in time to be presented to the committee. (Reads letters.)

MR. LEWIS, of the Committee on Place of Meeting, read the following report:

MR. CHAS. H. RUST, PRES. AM. SOC. MUN. IMPTS.,

SIR: The Committee appointed to recommend the city to be selected for the next meeting of the Society, begs to report that it has received and considered the following invitations:

1. From the Montreal Business Men's League urging the city of Montreal.
2. From the Cincinnati League urging the selection of Cincinnati.
3. From the Detroit Board of Commerce recommending their city.
4. From the Chattanooga Board of Trade urging consideration of their city.
5. From the manager of a hotel in one of the cities of the Middle West describing the attractions of his hostelry and incidentally recommending his city as an excellent place for our convention.

St. Louis was also recommended by a member of the Committee, although no formal invitation from that city has been received.

Cincinnati has already been visited by the Society.

Our convention has been held in Tennessee and it was not thought wise to recommend another city in that state.

Detroit is admitted to be one of the most attractive convention cities in the United States, but has never had a membership in the Society.

The claims of hotels were not thought worthy of consideration.

The question was narrowed down to Montreal and St. Louis, the principal claim of the latter being the fact that the Louisiana Purchase Exposition is to be held there next year. There was a difference of opinion in the Committee as to whether this constituted an advantage or a detriment. A majority of your Committee finally settled upon St. Louis and decided to recommend that city for the convention of 1904.

Respectfully submitted,

ERNEST STEECE,
WILLIAM FORTUNE,
Committee.

MR. LEWIS: The committee did not have before it the communications from St. Louis read by the Secretary. I shall therefore give you an outline of what the committee did last evening.

Permit me to say in this respect that due consideration was given by the committee of the fact that probably the most unsuccessful convention we ever had was at Niagara Falls during the Pan-American Exposition. I confess I am one of the minority who had grave doubts as to the wisdom of going to a convention city. I am not arguing against the report of the committee, but I think it only fair to give you some idea of the discussion we had in the committee. We have here a gentleman from St. Louis, and I think you should hear from him now that you have had a formal invitation from that city.

SECRETARY TILLSON: Was anything said about a hall to meet in?

MR. LEWIS: No, sir; we have heard nothing of that from St. Louis. This letter seems to intimate that a place for the meeting will be provided. That would seem to be done in a rather wholesale way, but whether this will be remembered when the time of meeting arrives I don't know.

SECRETARY TILLSON: There was a circular accompanying the letters inviting us to hold our meeting in St. Loius. This circular gives information, in a general way, about halls. If you wish I shall read the circular.

TO SOCIETIES AND CONVENTIONS:

The facilities for conventions and congresses at the Universal Exposition, St. Louis, 1904, surpass in extent and convenience anything heretofore offered at an Exposition. They are as follows:

In the Exposition grounds:—

1 hall seating 4,000 people.
2 halls seating 800 people each.
1 hall seating 650 people.
1 hall seating 240 people.
1 room seating 400 people.
1 room seating 160 people.

Also many smaller rooms for committee and small-section meetings.

Outside Exposition grounds:—

Exposition Building, Olive, and 13th and 14th Streets.
1 hall seating 2,776 people.
1 hall seating 6,500 people.
1 grand Coliseum, seating 10,000 people.
1 hall seating 850 people.
2 galleries seating 400 people each.
2 galleries seating 210 people each.
5 committee rooms.

These halls and rooms are all well-seated and lighted and under the janitor service of the Exposition Company.

It is therefore simply a question of arrangement of dates to amply provide for the meeting in St. Louis in 1904 of any and all societies that are holding conventions during next year.

Yours very respectfully,
(Signed) HOWARD J. ROGERS,
Director of Congresses.

MR. TILLSON: I should understand from that that if any society held a meeting in the halls inside the grounds the members would have to pay admission every time they entered.

MR. SHERRERD: I think these halls are so arranged that there is an entrance from outside the grounds to the halls, and if you wish to go from the halls into the grounds you pay admission. While they are connected with the grounds they have an entrance from the outside.

MR. MCMATH, St. Louis: I am in rather a peculiar situation. I am a resident of St. Louis, and am under obligations to recommend the association to hold its next meeting in that city. I am inclined, however, to sympathize with the position of Mr. Lewis, that a convention city is not well adapted to a meeting of this Society. In a convention city there are so many other attractions that the members will probably do as they did in Nashville and Niagara Falls during the time of the expositions held in the former place and at Buffalo. Our experience in those cities indicates to me that a society with the objects in view our association has is not wise in selecting a convention city for a place of meeting. There is another side to the question, however. I presume every member of the Society intends to visit our city during the exposition, and may arrange to make the trip at the time of this meeting and remain over a few days after its close to visit the exposition. Those who can make arrangements to see the exposition entirely independent of the convention will be able to see it satisfactorily. Those who only stay the two or three days of the convention cannot see much of the exposition and attend the sessions of the convention. The exposition will be very interesting to all of you, and you can see there a great many things relating to the work in which you are engaged. The invitation you have received is in one sense a general one. The exposition management is endeavoring to invite all organized bodies who hold conventions to meet in St. Louis during the exposition. There are a great many things which can be seen there, and if you will spend sufficient time you can see considerable of the city outside of the exposition, which I assure you is worthy of being seen. Of course under the circumstances it is not to be expected that there would be any set occasions when you could devote a day to seeing objects of interest in the city; that could hardly be expected, but many of these things could be seen. I think, however, you would have to limit your sessions to one a day. On account of the other attractions I don't think you would be able to hold more than one session a day. I don't think there is any question about the members finding sufficient entertainment, although I am not prepared to say what it would be, but I think they could be suitably entertained. I am not familiar with the location and arrangement of the halls. I think, however, Mr. Sherrerd is correct when he says it is not necessary to pass through the exposition grounds to get into the halls. There is one thing, perhaps, that will be as good an object lesson as can be found, and that is the way in which large crowds will be handled at the exposition. Perhaps it may not be amiss to say that the exposition grounds are nearly five miles from the central part of the city, and the question of transportation is a very important one.

Mr. Ballard: I am very much in favor of holding the convention in St. Louis. In the first place, I believe there are a great many members of this Society who will want to go to St. Louis to visit the exposition. If we hold our meeting anywhere else we will have to give up a week for that, and many members cannot spend the time for both trips. We can go to St. Louis for our meeting, and then stay long enough to take in the exposition. I don't think there is any reason why the holding of the meeting in St. Louis would keep us from having a good attendance at the sessions. We could hold a meeting every morning, have it started promptly, get through with it by noon and then take the afternoon for visiting the exposition. Of course that is a matter of detail, but I believe the holding of the convention in St. Louis will induce many people to join the association. A great many people connected with municipal affairs will visit the exposition, and they will be apt to join the association. One of the objections made to holding the meeting in a convention city is that there will not be a good attendance at the sessions. Half the membership has not been in this hall at any session since we have been in this city.

MR. BROWN: I move that the report be received, and that St. Louis be the next place of meeting.

Seconded by Mr. Ballard and carried.

MR. BENZENBERG: The Committee on Nominations is ready to report. We offer the following:

TO THE OFFICERS AND MEMBERS OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

Your Committee on Nomination of Officers submit the following as their recommendation:

President—G. M. Ballard, Newark, N. J.
First Vice-President—A. Prescott Folwell, Easton, Pa.
Second Vice-President—C. C. Brown, Indianapolis, Ind.
Third Vice-President—W. B. Howe, Concord, N. H.
Secretary—G. W. Tillson, Brooklyn, N. Y.
Treasurer—F. J. O'Brien, Oswego, N. Y.
Finance Committee—Emmet Steece, Burligton, Ia.; B. E. Briggs, Erie, Pa.; Alcide Chaussé, Montreal, Canada.

G. H. BENZENBERG,
M. R. SHERRERD,
M. W. MURPHY,
JOHN JONES,
C. C. BROWN.

On motion the report was received and concurred in, and the Secretary was authorized to cast the ballot of the Society for the names mentioned in the report.

The Secretary announced that he had cast the ballot, and President Rust declared the officers duly elected.

MR. BALLARD: I think this is rather an undeserved honor, to say the least. This is the fifth meeting of this association since I have been a member, and I have attended four of them. I was unavoidably detained from one meeting. However, I think this honor is undeserved, because there are many members of the Society who have done so much more work than I have who should have been thus honored instead of your humble servant. However, I accept the honor you have conferred upon me, and thank you sincerely for it. I shall endeavor, so far as lies in my power, to preside over your deliberations at least as well as those who have gone before.

MR. BENZENBERG: I am glad to hear you promise to do better than we have done heretofore.

MR. BALLARD: I haven't done that.

MR. BENZENBERG: He has admitted that he has not done as much work as the others. The committee suggests that during the coming year he exert himself to bring about a good attendance.

MR. BALLARD: I shall certainly do all within my power to do this, and I shall take great pleasure in calling upon Mr. Benzenberg to assist me all the year through.

PRESIDENT RUST: I think the Society is to be congratulated upon the election of Mr. Ballard as President. He has worked hard during the past year, and has been very enthusiastic about the Society.

Secretary Tillson read the following report of the Finance Committee:

Indianapolis, Ind., Oct. 21, 1903.

THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

GENTLEMEN: Your Committee on Finance, to whom was referred the reports of the Secretary and Treasurer, begs leave to report as follows:

Your Committee finds the accounts regularly and well kept, and therefore recommends that the reports be accepted.

Respectfully submitted,
EMMET S. STEECE,
FRED. GIDDINGS,
Finance Committee.

MR. FISHER, of the Committee on Street Lighting, made the following report:

REPORT OF THE COMMITTEE ON ELECTRIC STREET LIGHTING.

THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

GENTLEMEN: Your committee has no extended report to offer at this time. It was fortunate, however, in securing a paper from Mr. H. W. Hillman, of the General Electric Company, upon the question "Have Improvements in Electric Arc Street Lighting Kept Pace With Other Municipal Improvements?" and one also from Mr. Austin S. Hatch, Superintendent of the Detroit Municipal Electric Lighting Plant, on "The Records of the City Electrician." The chairman of your committee will also present a few statistics gathered from the records of the lighting service of the City of Rochester, N. Y.

With reference to the cost of lighting, your committee presents no detailed tables of prices paid for arc lights in American cities. The usual contract period for arc lighting is five years. Tables of cost were given in our own reports for the years 1897 and 1902. We have made general comparisons of the cost in eight representatives states. For the purpose of comparison, 2,000 candle power is estimated at 450 watts.

STATE	Average Hours per Year		Contract Price per Lamp per Year		Cost per Lamp per Hour		Watts per 1 cent Open Enc.		
	1897	1902	1897	1902	1897	1902	1897	1902	
California	2887	2365	$119 63	$94.50	$.045	$ 042	103	102	144
Colorado	3387	2904	130.67	95.68	.043	036	123	150	110
Illinois	2668	2291	76.74	67 57	.031	.034	137	140	183
Indiana	2590	2483	81.39	66.72	.035	.026	132	178	175
Massachusetts	2563	2596	79 12	85.86	.037	.039	87	120	109
New York	3230	3030	81 96	75.90	.026	.028	140	170	189
Ohio	3413	4049	79 56	38.92	.025	.014	177	184	200
Pennsylvania	3925	3704	86 14	60.59	.022	.018	196	241	277

In general, it may be said that there has been a gradual reduction in price paid per lamp per year for arc lighting, and a very marked increase in the amount of light furnished for a given sum. Statistics giving averages of cost under such extreme variations in local conditions as exist can be made use of only in a very general way in any particular locality.

LAMPS, POLES AND WIRES.

Many of the otherwise beautiful streets of our cities are still disfigured by an unnecessary number of unsightly poles and overhead wires. The street lamps, lamp posts and attachments are also in many cases in perfect harmony with their unsightly surroundings. There is no branch of municipal work where the protests of indignant citizens are so numerous and violent as against the continuance of these unsatisfactory conditions. Your committee is especially fortunate in having presented to this convention a demonstration from the manufacturers of electric lamps and appliances, that the most efficient up-to-date lamps are also the most ornamental. It is further a source of gratification that such lamps and fixtures are rapidly superseding the former less handsome ones.

Complete records of the existing conditions are also an essential to any improvement. The paper by Mr. Hatch gives the pracitce in the second largest municipal electric light plant in this country, and the one most referred to as a model for plants.

The question of municipal ownership of electric street lighting plants has been prominently before the public during the year. General statistics of the operations of these plants are of little value as a guide in determining the advisability of establishing such a plant in any given locality. We believe great advances will be made in the efficiency of street lighting in the near future. One result of these betterments will be to render useless much of the present electric machinery. It may be well to consider whether some system of regulating rates, similar to that in vogue in the City of Boston, where the price charged is subject to revision at stated periods by arbitration, will not for the present offer in many cases advantages over municipally-owned and operated plants. The report of the 5th Annual Convention of this Society contains a complete description of the Boston contract.

E. A. FISHER,
Chairman.

Mr. Fisher also read the following paper:

SOME STATISTICS RELATING TO THE STREET LIGHTING OF THE CITY OF ROCHESTER, N. Y.

BY EDWIN A. FISHER, CITY ENGINEER.

The city has a total area of 11,365 acres, or 18.18 square miles. In this area are about 320 miles of streets and alleys. On January 1, 1903, the city was lighted by 2,804 electric arc lamps and 141 gas lamps. Omitting the gas lamps, the city had an average of one electric lamp for 3.68 acres, and an average of 8¾ lamps per mile for the entire area. A portion of the ctiy is not yet built up and has no street lights, therefore the average number of lamps per acre, and per mile, for the portion lighted is somewhat larger. Going a little further into detail, it should be stated that a portion of the business district is lighted by the double arc light system, two lamps on one pole. The lamps are of the enclosed type, operated in parallel on a 115 volt current. The larger part of these lamps are operated on the direct current. The poles are of iron and serve also as trolley poles for the electric railway. The railway poles are generally 125 feet apart. This condition was a controlling factor in locating the lamps.

On Main Street the two principal street crossings have four double arc lamps, one on each corner. At the other street crossings two double lamps are placed. In a distance of 6,400 feet there are 61 pairs, or 122 lamps—an average of one pair of lamps per 105 feet of street. This street is probably the most brilliantly lighted street in the world.

This double system is in use on 8 miles of streets. In this distance there are now 240 pairs of lamps, or an average of 30 pairs per mile. The average distance apart is 188 feet.

These lamps are what are known as 1,200 candle power, and are specified to operate on not less than 5 amperes of current with 72 to 80 volts requiring not less than 360 watts at the arc for direct current lamps, and 5½ amperes with 72 to 80 volts requiring not less than 360 true watts for the alternating current.

A portion of these lamps are placed at street intersections. The length of street lighted is about 50 per cent. more than the length of street on which they are placed. The total length of street lighted is therefore about 12 miles. The 480 lamps cost $66.61 each per year, or a total of $31,972.80 for 12 miles of streets, or $2,664.40 per mile of street. The wires in this district are underground.

The other portion of the city is lighted generally by single are lamps attached to wooden poles operated on the direct current series system. At the present time they are mostly open arcs of 9½ to 10 amperes, and 45 to 50 volts at lamp terminals. The contract provides that all open arc lamps shall be changed to the enclosed, within five years. The specifications require an alternating current of 7.5 amperes, 72 to 80 volts at arc requiring 450 true watts energy at arc. The company has begun to make the change and is now operating 58 of the 7.5 ampere lamps. A few enclosed arcs are also operated on the 10 ampere direct current. The average distance apart is 360 feet. As many of these lamps are located at street intersections the average distance of street lighted is about 50 per cent. more, or about 540 feet; an average of about ten lamps per mile. These lamps cost $78.50 per year. The cost, therefore, is about $785.00 per mile of street. The wires in a large portion of this district are overhead.

TESTS.

Recent current measurements taken with the ammeter, the volt-meter and the watt-meter in connection with luminometer measurements, show the following results:

Series direct current *open arcs* average 9.8 amperes, 50.5 volts, 490 watts, 151 to 180 feet luminometer distance.

Series alternating current *enclosed arcs,* 7.50 amperes, 64 to 74 volts, 500 to 560 apparent watts, 400 to 450 true watts, 120 to 165 feet luminometer distance.

The above are known as 2,000 c. p. lamps.

Constant potential direct current enclosed arcs, 5 amperes, 74 volts, 360 watts, luminometer distance 121 to 156 feet.

Alternating current enclosed arcs, 5.5 amperes, 80 volts, 440 apparent watts, 374 true watts, luminometer distance 120 to 153 feet. These lamps are known as 1,200 c. p. lamps. The luminometer distance was shortened in some cases by dirty globes. A clean opal inner globe, and a clear outer globe, gives the best effect.

OUTAGES.

The outages of lamps are reported daily by the police, on blanks prepared for the purpose. They also notify the lighting company by telephone. The company maintains a night patrol of three or four wagons, with two men to each wagon. The outage reports for seven months of 1903, ending September 1st, have been analyzed with the following result:

Open arcs, 2,190. Total number reported out in 7 months, 243 nights, over one-half hour, 2,106; an average per night of 8.67 lamps, or 41/100 of one per cent.

Enclosed arcs, 614. Total outages for same time, 120; an average of 0.50 lamp per night, or 8/100 of one per cent.

Boston reported for 1898, 2,893 lamps, mostly open arcs; 85/100 of one per cent. outage; and for 1899, 3.024 lamps, mostly enclosed arcs; 27/100 of one per cent. outage.

Detroit, for 1900, 2,035 lamps; 11/100 of one per cent. outage.

St. Louis, for 1902, 953 lamps; 106/100 of one per cent. outage.

The following table showing compartive cost per capita and per acre for street lighting in eight American cities was compiled from the U. S. Census Bulletin of Labor for September, 1900:

CITY	Cost per Capita	Cost per Acre (Total Acreage)	Cost per Mile of Streets (Total Mileage)
Providence, R I..........	$1.72	$25.85	$1 310 00
Rochester, N. Y.......1899	1.44	.....	....
.......1900	1.52	......	....
...... .1903	1.30	19.00	700.00
Boston, Mass............	1.21	11.20	....
Cincinnati, O.............	1.05	16.43	....
Buffalo, N. Y.............	0.97	13.51	530 00
Philadelphia, Pa..........	0.88	13.40	754.00
Indianapolis, Ind..........	0.67	6.34	....
Columbus, O.......	0.60	7.18	....

In view of the comparatively low price paid for electric lights and the high per capita cost and high cost per acre, exceeded only by Providence, R. I. and Yonkers, N. Y., the speaker believes that Rochester can justly claim to be one of the best lighted cities in this country.

A paper on the subject, "Have Improvements in Electric Arc Street Lighting Kept Pace with other Municipal Improvements?" by W. H. Hillman, was read by Mr. Fisher.

Mr. President, and Gentlemen of the Association: It gives me pleasure to talk before you to-day on a subject so near to the interests of municipal improvements, and yet one of the most important branches of the electrical industry. During the past few years, the manufacturers of electric street lighting material, and the electric lighting companies in general, have devoted much thought and attention to this subject.

The object of this paper is to demonstrate how closely such companies have co-operated with this Association, with a view of beautifying rather than disfiguring the streets, and keeping well abreast, if not ahead, of the procession, marching on toward further municipal improvements.

Fig. 1 illustrates the poles and lamps installed on Fifth avenue, New York City. This is one of the best lighted streets in the world. Either night or day, it is representative of the best practice which the advancement of the art permits. The New York Edison Company owns these poles and lamps; also furnishes current for lighting. The policy of this company has been to install ornamental poles and the most modern arc lamps throughout the entire City of New York.

Fig. 2 shows another form of pole in connection with which an illuminated sign is a part of the pole equipment. The practical value of this sign at night has been written about and talked about so much that it is unnecessary for me to add anything further. Its design being tasty and attractive also during the day time, it represents a municipal improvement in connection with which the New York Edison Company deserves much credit.

Those acquainted with New York will recognize Fig. 3 as the "Isle of Safety." How easy it would have been to arrange the arc lighting system so as to thwart the artist's design of beauty. On the contrary, it is entirely a work of art, completed by the engineering skill of the New York Edison Company. Incidentallv, it was necessary to turn the lamp upside down and equip it with a new and latest design of mechanism; but the grand point of the entire scheme was when the artist and engineer came together and, with one accord, effected that design, which will stand for all time as a monument in honor of municipal improvements.

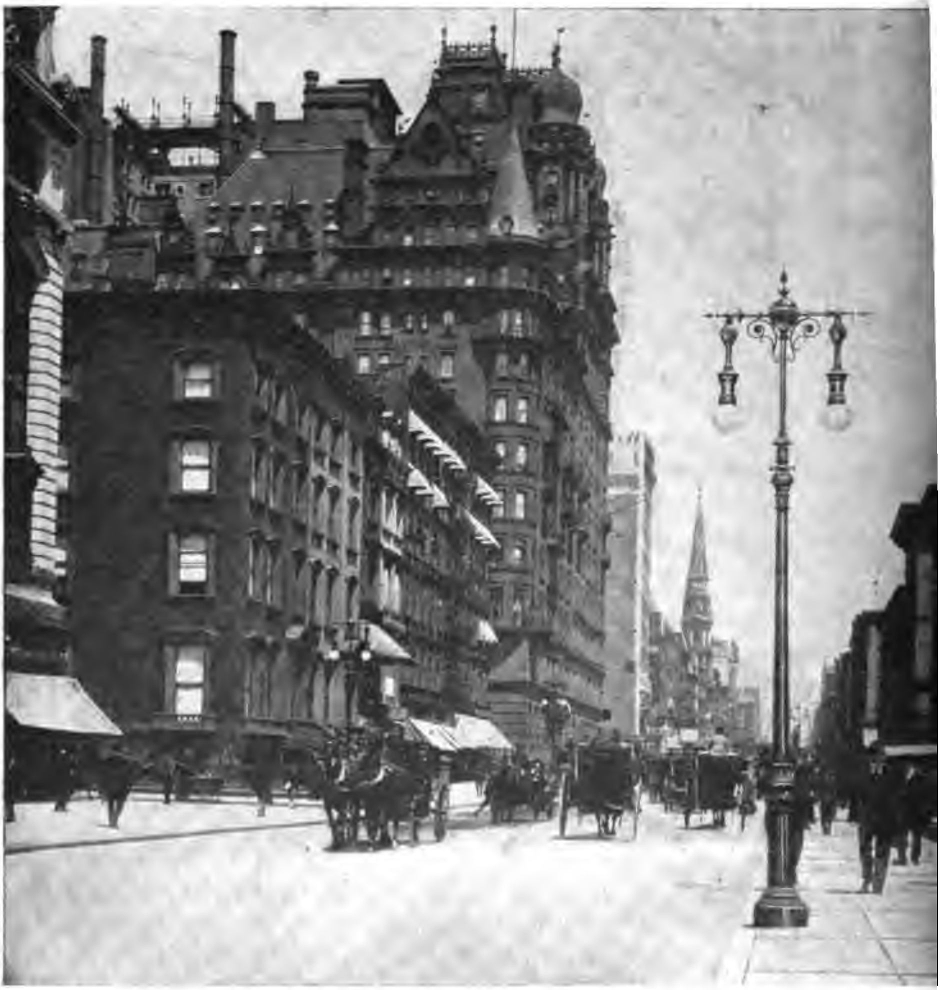


Fig. 1—Fifth Avenue, New York City.

Not desiring to dwell at length on New York City lighting, I do wish to call your attention to Fig. 4. Again this illustrates the determined desire on the part of the electrical industry to advance electric street illumination only as it harmonizes with the attractive and ornamental appearance of other street requirements. Here the lamps are installed on bridges, and a careful inspection will show one of the prettiest designs of ornamental poles, especially considered in connection with the trimmings on the bridge, and particularly designed as a part of the bridge. In this installation, I claim the utmost degree of engineering skill in behalf of municipal improvements.

The City of Boston has been highly favored in respect to ornamental electric arc street lighting. Everywhere throughout the city and suburbs of Boston will be found the so-called "Boston Ornamental Poles." Upwards of 7000 electric arcs illuminate this city, each and every arc being suspended on an ornamental pole. The Boston Edison Illuminating Company has made itself world famous by the installation of the electric enclosed arc street lighting system. It was not an easy problem for them to change their several thousand arc lamps and install a system entirely different from that which had been so extensively adopted and approved during the previous years. Notwithstanding, their efforts met with grand success and this Association can well afford to follow me in my endeavors to present the many features of this enclosed arc system which represent municipal improvements of a high order. (See Fig. 5.)

There are 8760 hours during the year. Allowing 3700 hours for darkness, there remain approximately 5000 hours of daylight, when arc lamps and poles are on exhibition before the citizens of our communities. Fig. 6 shows an old style hood and cut-out. The new style ornamental pole is equipped with a cut-out concealed within the pole, and the lamp is made weatherproof, so as to require no hood protection. Where ornamental poles are not available, Fig. 7 illustrates a modern cut-out of ornamental design.

The new system includes a very attractive light reflector, its under surface being finished in white enamel. This will not rust or be subject to injury from the elements. It will therefore retain a white glossy appearance, with frequent attention from the attendant trimming the lamp. Its shape is symmetrical and in harmony with the size of the lamp. (Fig. 8.)

The globes of the new system offer marked improvement over the old style. Fig. 9 shows an exterior construction of the lamp, the globe being open at the top. Ample opportunity was afforded for the wind to blow the arc, and occasionally chunks of carbon would drop down into the globe. Dust and dirt accumulated there, which could not be easily brushed out. As a result, the globes easily became dirty and presented a bad appearance.

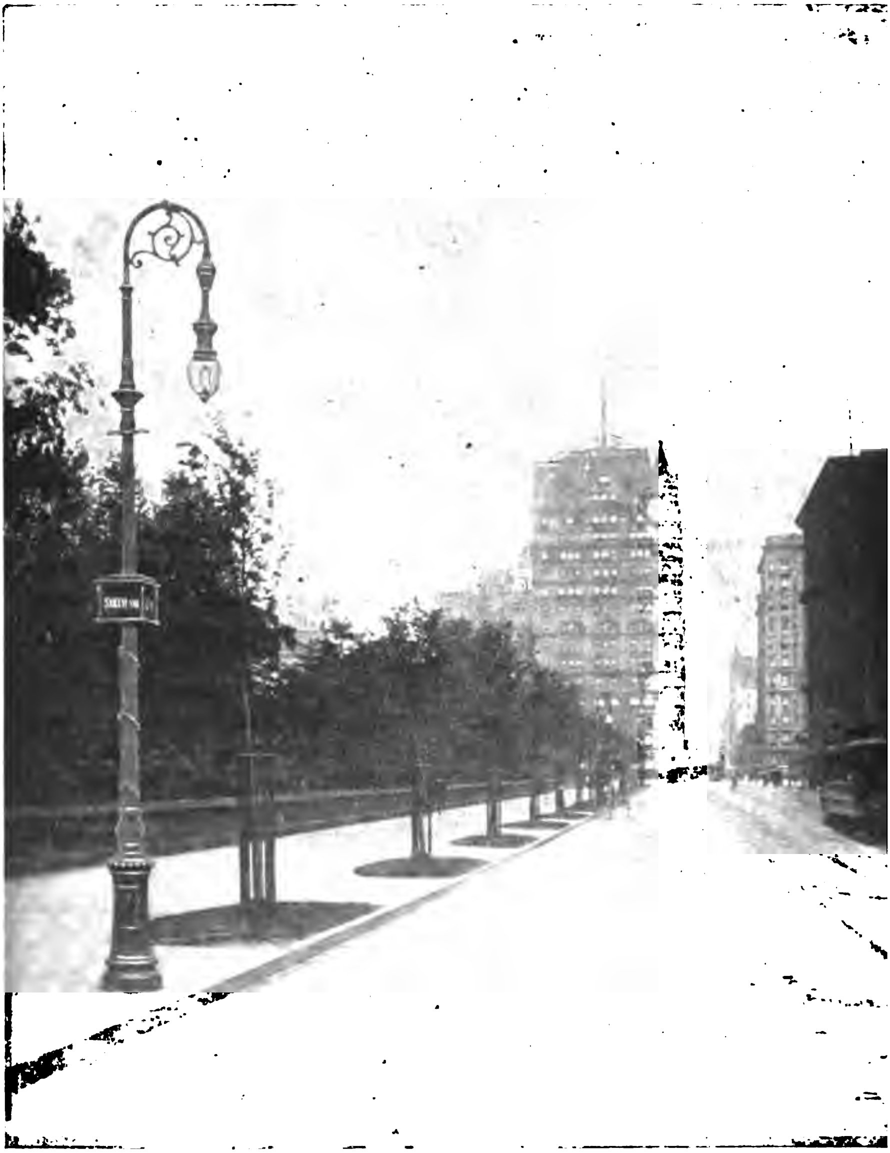


FIG. 2—ORNAMENTAL POLE WITH ILLUMINATED SIGN, NEW YORK CITY.

Fig. 10 illustrates a new enclosed lamp. Its inner globe prevents the carbon from dropping into the outer globe. The lamp casing rests snugly against the outer globe, and at all times insures a clean appearance.

Fig. 12 shows one of the new carriages of the Buffalo General Electric Company, which is used for trimming the lamps, carrying carbons, inner and outer globes, etc.

It gives me much pleasure to illustrate this carriage, as it suggests a strong argument in favor of municipal improvements. In past years, the old style lamps required trimming each day, and it was not uncommon to see an old express wagon stop across the electric car tracks, holding up 50 or 100 merchants on their way to business, in the street cars, while the arc lamp was being lowered, trimmed, and raised again into place. Municipal improvements are surely favored to-day, when a rubber-tired buggy, of attractive design, is driven to a lamp once a week, and the lamp does not have to be raised and lowered in the street for trimming.

In a recent conversation with an electric lighting manager in the Pennsylvania territory, he stated that it was as much as a trimmer's position was worth to leave a broken globe on a lamp more than 24 hours. Surely, such systematic efforts are co-operative with your own advanced ideas on municipal improvements.

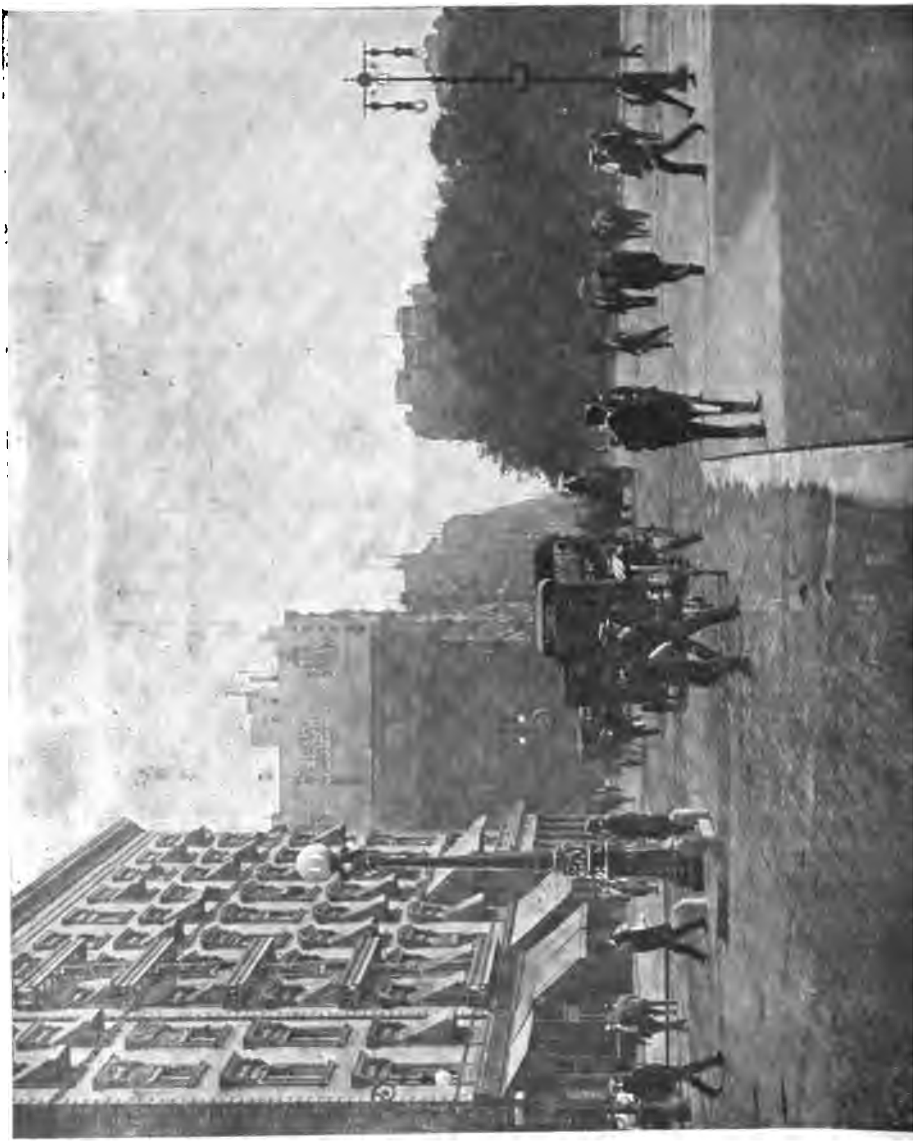
HAVE MODERN IDEAS REGARDING ORNAMENTAL FEATURES INJURED THE OPERATING END OF THE ARC LIGHTING BUSINESS?

On the contrary, there never was a time in the history of arc lighting when the regulation was as good as it is today.

A chart of the current variation on an enclosed arc street system, which is nearly a straight line without any variation. As a result, the 3700 hours of darkness during the year are protected by a system so steady in operation as to have been commented upon by the most prominent electrical engineers of the country. The distribution of light has been improved, and the new system is the result of a new patented device known as the Street Luminometer. This instrument is considered to be a very valuable device. It is an easy and excellent method of proving to city authorities the comparative value of light distribution of the old and new systems.

The engineering improvements in hangers and cut-outs have minimized the danger of handling arc lighting circuits. This is a point which can be appreciated by everybody, regardless of the degree of technical education with which one may be favored.

After all, interruption of service is what the citizens wish to avoid. Some of the systems have decreased the number of interruptions and out-



ages to such an extent as to amount to less than one-half of 1% per night. This is a wonderful record, and could be attained only by reason of the improvements which have been effected in electric arc street lighting.

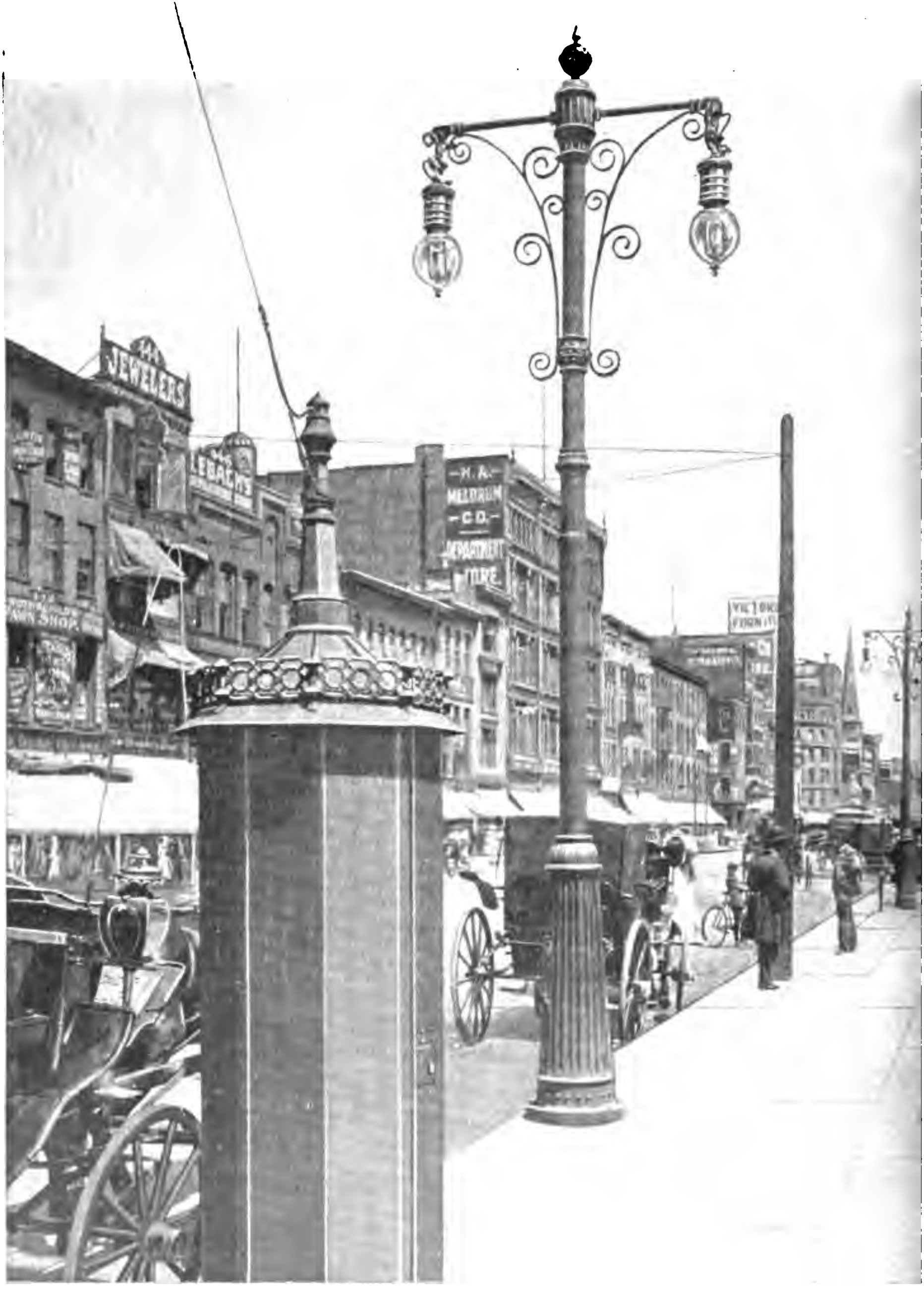
The members may well ask at this point, to what extent have these improvements been carried out. In New England territory, practically 70% of the street lamps installed represent the enclosed arc system. In the New York territory, the figure is nearly as high. Through the entire United States, the enclosed arc system is being installed at the rate of 50,000 arc lamps annually, and there are already installed upwards of 150.000 enclosed street arcs, in all sizes of cities and towns in this country.

IS YOUR METHOD FOR PROMULGATING ADVANCED IDEAS ON MUNICIPAL IMPROVEMENTS AN EFFECTIVE ONE?

I do not hesitate to claim that the methods of the electrical companies for disseminating new ideas are second to none. To illustrate, the New York Edison Company issues a monthly bulletin to its customers. This bulletin reaches all classes. In connection with residence lighting, the families read the electrical news. In connection with the various classes of mercantile work, the proprietors of large and small stores alike, read this bulletin. It is one of the most widely published pamphlets issued, and, as if in honor of your Association's meeting to-day, their last bulletin was particularly devoted to ornamental street lighting (I take pleasure in handing to your Secretary a copy of this bulletin). I claim that the electrical industry has attained an enviable position when almost every man, woman and child in the residential district, and nearly every proprietor, clerk and boy in the commercial district, has an opportunity, every 30 days, to read the most advanced ideas in connection with electrical improvements. If, in the future, such methods of disseminating new ideas in connection with the electrical industry shall continue, the cause of ornamental street lighting will be greatly advanced, and Municipal Improvement Associations will have reason to rejoice.

Further, regarding the method of promulgating advanced ideas on municipal improvements in connection with electric street lighting, one of the largest manufacturers of arc lighting material in the world has issued, in the past few years, hundreds of thousands of pamphlets, profusely illustrated and recommending most modern arc lighting practice to the electric lighting companies throughout the country. This company will issue upwards of 50,000 of such pamphlets during the lighting season, which will be representative of hearty co-operation along the lines of municipal improvements.

In closing, I wish to express my appreciation of the honor which your Association has conferred upon me in connection with this paper. As a



ORNAMENTAL POLES IN BUFFALO, N. Y.

representative of the electrical industry, I pledge myself to the hearty support of that policy which will advance the interests of municipal improvements, and it is the writer's opinion that the electrical industry as a body will pursue an aggressive policy in favor of this most worthy subject.

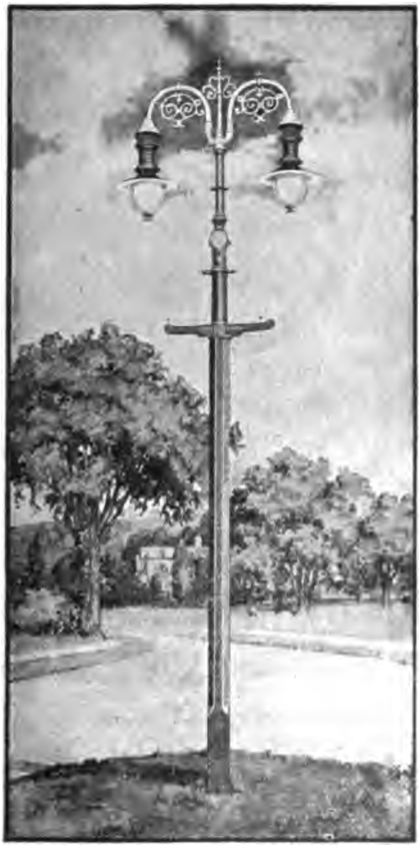


FIG. 5—ORNAMENTAL POLE, BOSTON, MASS.

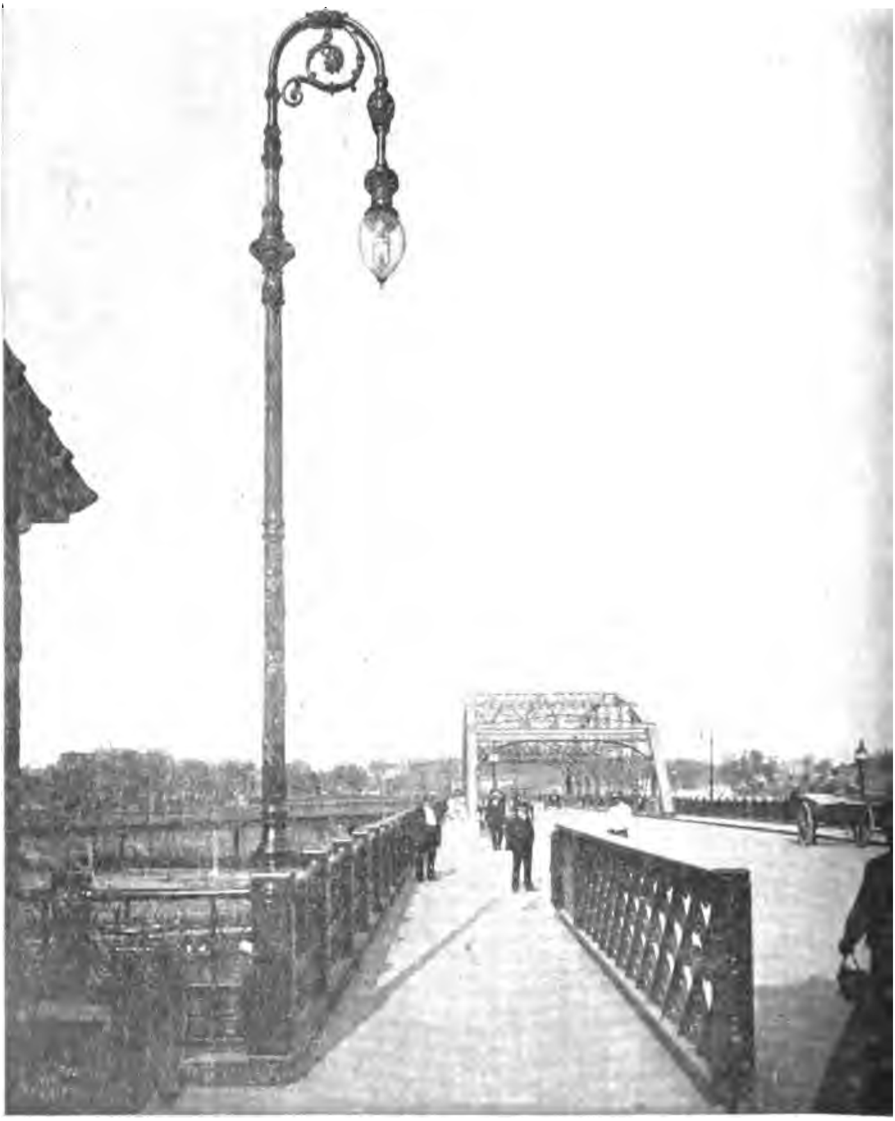


Fig. 4—Lamps Installed on Bridge.

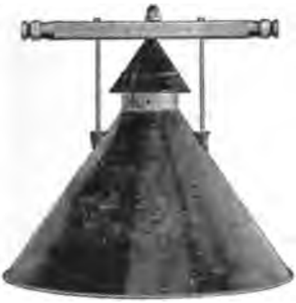


FIG. 6—OLD STYLE HOOD AND CUT-OUT.

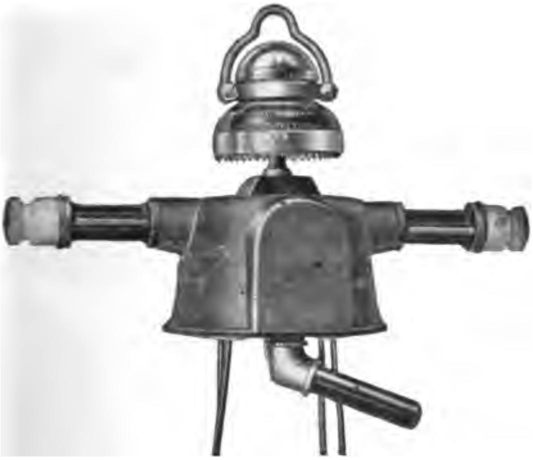


FIG 7—MODERN CUT-OUT.

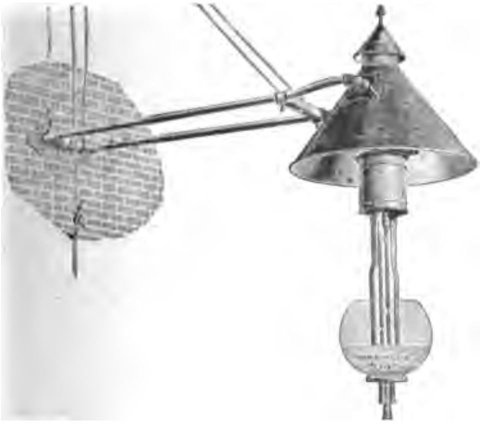


FIG 9—OLD STYLE OPEN ARC LAMP WITH HOOD.

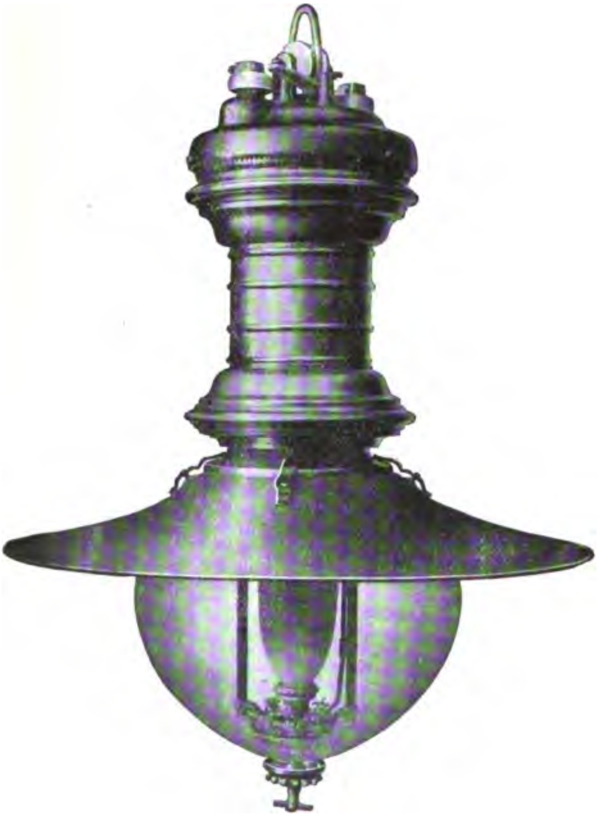


Fig. 8—Enclosed Arc Lamp With Reflector.

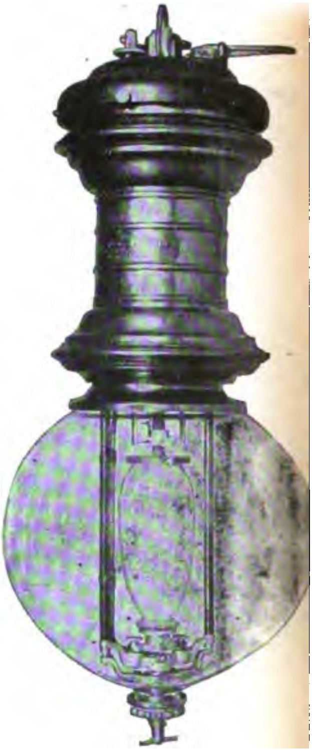


Fig. 10—Enclosed Arc Lamp

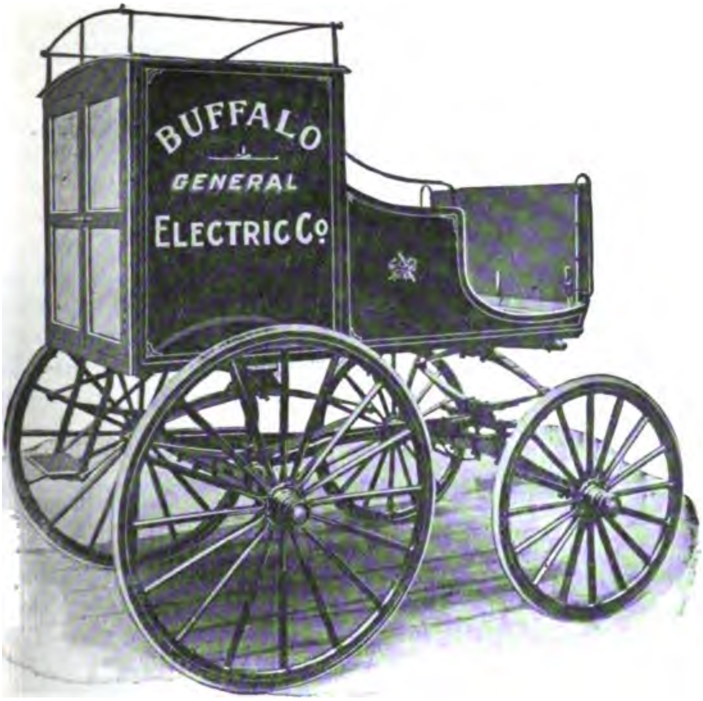
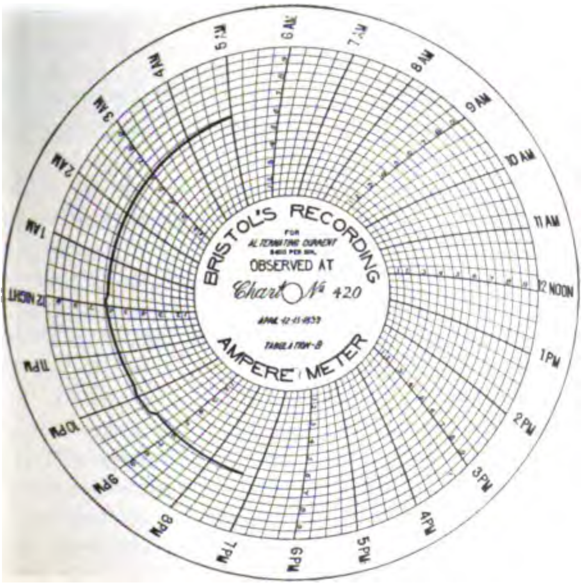


FIG. 12—TRIMMER'S CART OF THE BUFFALO GENERAL ELECTRIC COMPANY.



RECORD CHART SHOWING REGULATIONS OF CONSTANT CURRENT TRANSFORMERS.

MR. A. S. HATCH, Detroit, read the following paper on "The Records of the City Electrician."

This subject is like a woman's work—never finished—so the design I have in this paper is more to bring before the convention the different systems used by the cities represented here, particularly the auxiliary methods which have been adopted by members for their own convenience to comply with some special ordinance or law, and it may be just the missing link in some other engineer's records. So, I hope the convention will not consider the system of records and reports as complete but only an outline for the purpose of opening discussion and enable all to profit by one another's experience. In a former paper I called attention to the regulation of common carriers, and one sentence reads: "One common law of carriers is to so construct and maintain improvements that will expedite their own service. It must not hinder other carriers or mar the beauty and improvements of a highway. This one regulation, although the least thought of by the city fathers, is the most important one and needs the most careful consideration by the city electrician. He should seek to establish a code of rules, and get the necessary ordinances passed to enable him to enforce them, which will give equal rights to all and at the same time protect city rights and property. I submit, without reading, such a code which may be used as a guide in establishing one for any municipality. It may be well, however, for me to give a summary of them. There is no rule that has not been enforced in some municipality, although not all in any one. High and low tension wires must be kept on separate lines of poles and not more than two lines of poles in any street, provision being made for the consolidation of similar lines where necessary. Different ownership must also be designated, either by a brand on the cross arm, a peculiar insulator, either in color or shape, or even by a special method of tying the wire.

These rules require two things to make them of any value, first, the laws and ordinances to enforce them, with the penalties if broken; second, field records to keep track of lines and conduits, of pipes and sewers. The first is legislative, but the second should be attended to regardless of the first. Consequently, I have taken Field Records as the principal subject of my paper. These records should show the location of every pole and wire, every duct and manhole in the city, and can be best kept by the card system. I use cards 6x9 inches, since it is a convenient size to show a street intersection and half a block each way at a scale of 100 feet to the inch. Fig. 1 is an illustration of one of these sections. Different colors are used to designate different companies, whether pipes, poles and conduits or the wires of one company in the conduits of another. Each pole and manhole is designated by number. Figs. 2 and 3 show how each are

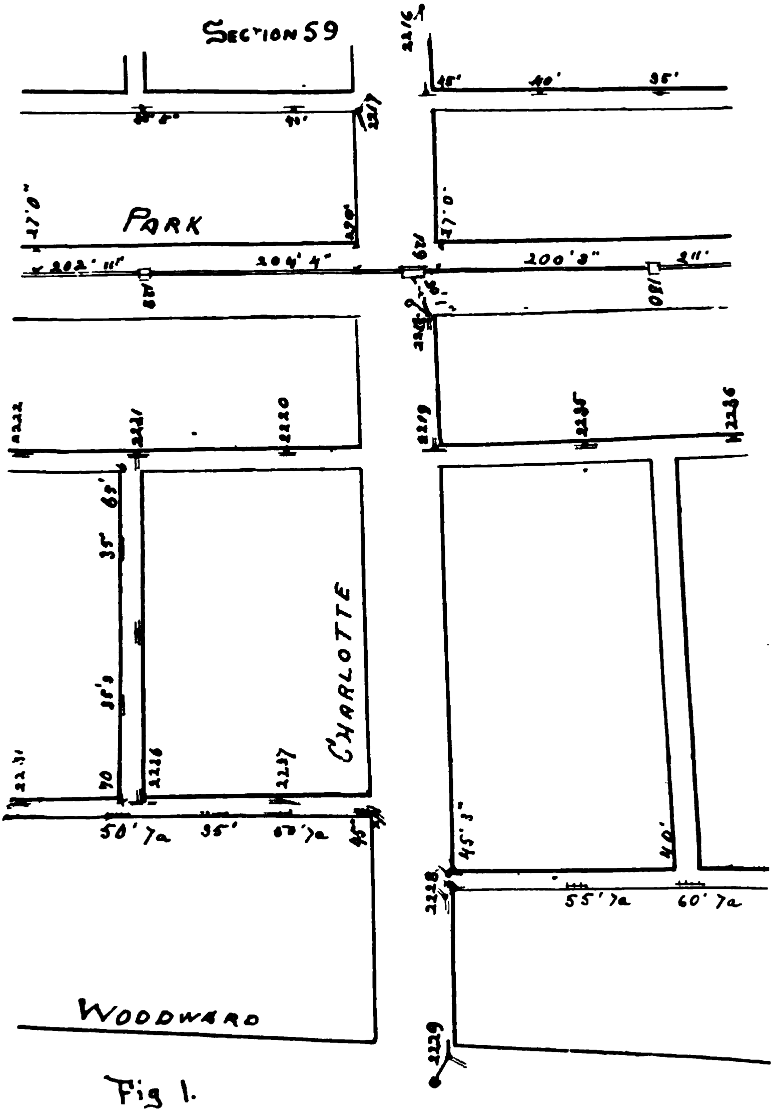


Fig 1.

kept. The cross arms are given in their proper places, and each pin or duct is made in the color which represents the company using it. The length and kind of wood of the poles, the size of manholes and distance between them is given, as well as the locations of street lamps, transformers, fire and police boxes. The pins in the cross arms are numbered

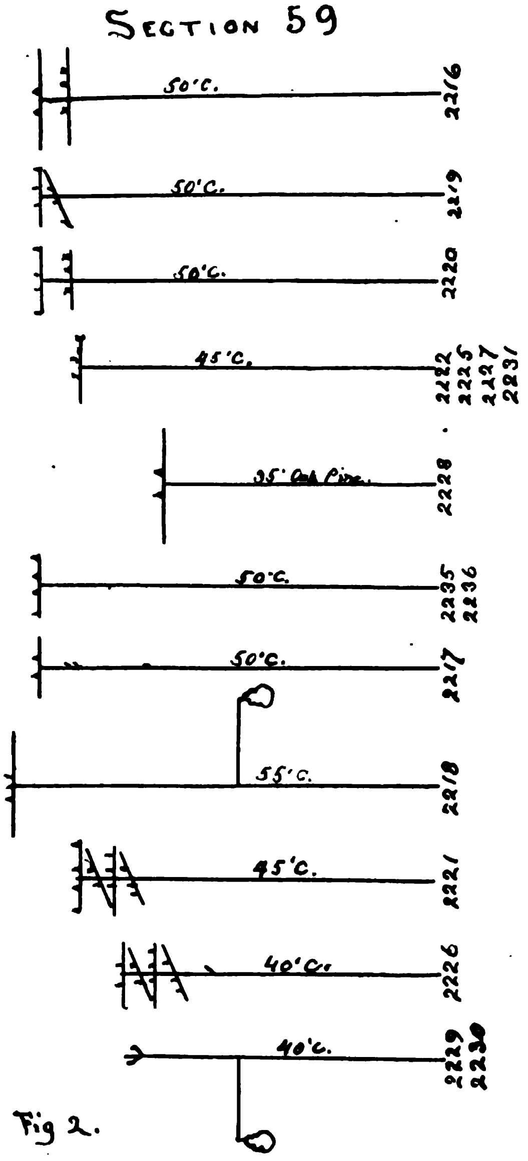
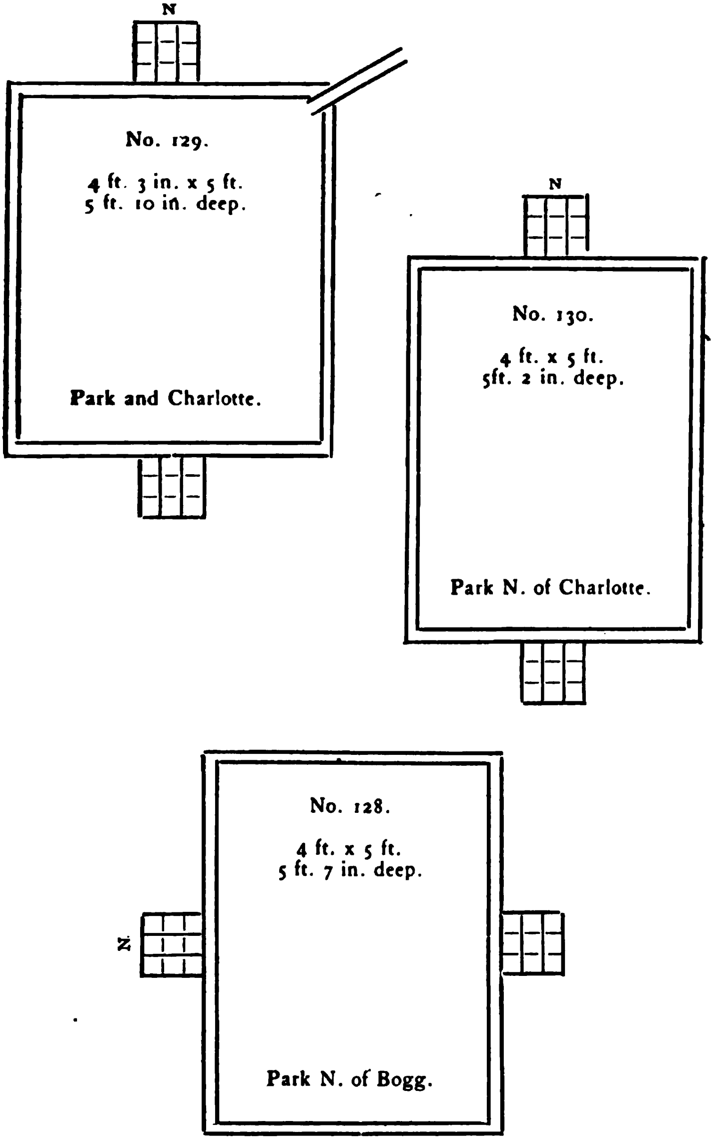


Fig 2.

from the pole each way, but the ducts in the manholes are numbered from left to right, standing back to the station of the company owning the system. The details of a street intersection can be more fully shown, if de-

Fig. 3.



sired, by a second plat drawn to a larger scale. Figs. 4 and 5 are tabulated records of this particular plat, showing one company's pole and conduit line only, but other companies are kept in the same manner. In the

FIG. 4.—CHARLOTTE, WOODWARD TO ALLEY E. OF CASS.

OVERHEAD.

	POLES					ARMS						RENTALS					
Pole Number	35 Ft.	40 Ft.	45 Ft.	50 Ft.	55 Ft.	4	6	8	Glass Ins.	Ft. of Wire		Teleph.		Still Alarm		Edison Co.	
2216				1			2		2	200	Charlotte, Alley E. Cass to Alley E Park.						
2217				1		1			2	340		1	2			1	3
2218					1	1			2	220							
2219				1		2			4	260	Alley E. Park, Bagg to Joy.						
2220				1		1			2	200							
2221			1			2			4	180				6	11	2	6
2222			1			1			2	...							
2235				1		1			2	240							
2236			1			1			2	240							
2225		1				1			2	280				1	1		
2231		1				1			2	180	Alley W.—Woodward, Bagg to Charlotte.						
2226		1				2			4	480		1	1	2	2	1	3
2227		1				1			2	340							
2228	1						1		2	240	Charlotte and Woodward.						
2229		1					Brackets		2	240							
2230		1					"		2	...							
	1	6	3	5	1	15	3		38	3640		2	3	9	14	4	12

FIG. 5.—CHARLOTTE AND PARK.

UNDERGROUND.

Installed	From Manhole	To Manhole	Lineal Ft. of Conduit	No. of Ducts	Lineal Ft. of Ducts	No. of Cables	Lineal Ft. of Cables
1897	128	129	204 4	9	1839		
May	129	130	200 8	9	1806		
	130	131	211 4	9	1902		
				1	20 1		
	Manholes,		616 4		5567 1		
			14		126		
			630 4		5693 1	6	34,058 1

Duct	
1	Fire Department.
2	
3	Edison Ill. Co.
4	Police Department.
5	
6	
7	P. L. C. Arc.
8	" "
9	" Incandescent. 2,200 volts.

same way, we have the manhole work, giving details of the manholes and ducts; the manholes are numbered, the distances given between manholes, the number of ducts and the amount of cable drawn in. Figure 6 is a

FIG. 6.—CHARLOTTE AND PARK.
MAST ARM.

ORIGINAL.

1895 Oct. 9	Started No. 1084.
1896 May 2	Changed to No. 481.
1897 April 5	" " 1142.
1898 April 27	" " 638.
Oct. 5	" " 1326.
1901 March 27	" " 1215.

record of the street lamp, class, when put in, dates lamp changed, lamp trouble, etc. These cards show all details connected with the section shown on the plat, but with other plats are cards showing the history of fire and police boxes and the electrical measurements between hydrants and railway tracks. It may seem a huge task to keep this system up, but I do not find it so. When I first started the record, I feared it would not be complete enough to be of service, but I find that one man can take care of it easily. This system, if the city electrician and engineer work together, —and all the techincal departments of a city should be under one head,— can be made a record of everything above and below ground.

Before leaving the subject of records, I wish to speak of the subject of indexing. It may seem that a system such I have outlined is of no consequence because it is not easy to refer to the particular section you want. I index by map sub-division. My case consists of twenty drawers, the city being divided into eighteen sections, leaves two drawers to spare. To illustrate my system: I have here (indicating) an outline of the City of Detroit. In order to keep the system complete in case of future extensions. I divide the city into two divisions, the western denoted by "W" and the eastern by "E". These districts are again divided into sections, one for each drawer; these drawers are divided in the same way, a special guide card designating the subdivided section and between these cards are shorter cards designating the plats. We will take the particular section in which is the plat taken for illustration. It begins as the map does, a, b, c, etc., vertically and 1, 2, 3, etc., horizontally, consequently in this particular section to which I have referred, the third section in the first vertical row is represented by "c 1" and its designation would be "W c 1." I have gotten so accustomed to the method of indexing that I can turn to any particular drawer and even section, without referring to the map as a guide. The great advantage of this system is its elasticity, since plats can be added to, altered or even eliminated and not affect another plat or section.

Similar rules and records to these should be established in every city, then annual reports would not only be more valuable than they are now, but far more easily compiled, and so compiled that one city's report could be compared with another. All city reports should be so divided that the different departments can be compared one with another, and thus enable a comparison of methods, which in some cases will result in decreased expenses. The following classification for reports could be used for any city department by an alteration of divisions only. The same classification should be followed in both operating and investment, and each division of each class should be itemized with regard to wages and material. The classes are five in number; first, fixed charges; second, executive; third, operating; fourth, maintenance; fifth, damages. Fixed charges include interest, insurance, taxes, depreciation, and such portion of the expenses of city offices and supplies in any way connected with the electrical department, as the total city expense bears to the electrical expense. These are such offices as the mayor, city clerk, treasurer and aldermen. Taxes should not be on the total valuation of a plant, but only that portion which a private company would have to furnish. This may be criticised, but I will give you my reasons for it. For instance, a fire alarm system, if run by a telephone company, would require line wires and boxes on existing poles and station apparatus in an existing plant. The executive department includes, in the second division, the office expenses, telephones, printing and stationery, engineering, foreign inspection and store room expense. The operating department has two divisions, station and line. You will see that this system can be carried out with any city government, even to the minor details of a waterworks system or any public works, even going to the point of an alderman's desires that he wishes taken care of. Station includes wages and supplies used in the operation of the station or exchange. The city engineer's expenses and expenses of the drafting room should be operating expenses since they are not executive offices. Fuel, oil, waste, brushes, towel supply, material used in the continual consumption of a plant and the labor required to handle them are station operating items, but supplies used to replace worn-out material is a maintenance. For instance, soap and soda used in washing wiping-towels are operation, but the towels themselves are maintenance. The cleaning and acid used in the operation of a storage battery is operation, while the paste and labor used on the plates is repair, and so maintenance. So also in line operation, inspection, trimming, patrol, are operation, but replacing globes, repairing burned switches or boxes and clearing a ground or open wire is a maintenance charge. Maintenance is repairs only; replacing something defective or worn out. Note the distinction between these three departments. The blanks used for the records of the operating and maintenance are for the benefit of the executive and so must be charged to the executive department. The fuel used in heating the executive and maintenance is a part of the operating department and is so charged; while repairing a broken chair in the office or a broken switch in the station is maintenance and charged to maintenance department. The difference between operating or maintenance and investment must also be carefully distinguished. A defective switch or fire alarm box replaced by another one like it is maintenance, but if replaced by one which is an improvement on the old, the value of the old is charged to maintenance, while the difference between that and the new is charged to investment. The idea is this: If you have an old water pipe, or an old open sewer which you are replacing by a tight sewer, you should charge the value of the old sewer to maintenance and the difference between that and the new to investment.

,The last division, damages, includes all acidents, expenses allowed on account of sickness, damages paid and alterations made to the system on account of foreign conditions which are not maintenance or for which a bill cannot be rendered. For instance: If you have a sewer you have to move, that is not a maintenance charge, but it is a damage charge, because it has to be moved on account of certain improvements in the city. It is not an investment, but comes from the natural growth of the city. Such an item would be the moving of a pole on account of a curb being changed or a house being built. Again, if an electric light plant supplies both municipal and commercial lights, the accounts should be kept for each department, dividing pro rata, according to the meter readings of the two systems. So also, a plant running both water and electric light should be divided according to the power used.

You may think the details as outlined above mean "red tape," but if you wish to know what you are doing you must have at least as much as given. The best commercial companies are far more careful of details, and I believe a large part of a city official's troubles come from the fact that he doesn't know the comparative costs of his departments. The plan I showed of the gas and water system have only the approximate dimensions shown. Our City Engineer's Department and the Electrical Department, whose records are very carefully kept, are still in error as to the exact location of these pipes. Those pipes were put in more than five years ago. Up to that time the records were not so carefully kept; but since that time they can be relied upon as correct.

Let me quote again from a former article: "If the employer should be a city instead of an individual, you may rest assured that what is everybody's business is no one's and the employes must do more than simply operate the business entrusted to them. Every employe pays for superintendence and inspection. The less you require looking after, the more able you are to stand alone and complete your tasks, the greater your reward." So I strongly urge you to establish such a system, even if you have to be superintendent, secretary, storekeeper, foreman and lineman and make the orders out yourself, to be filled by yourself, so you can take the material out to yourself to do the work yourself.

Possibly a description of the record system as used by the Public Lighting Commission of Dertoit may be of interest. The operating department is kept by log: the engineer's showing the coal, water, oil and waste used, the ashes taken out and the oil filtered, the times of starting and shutting down, the different engines and boilers as well as the names of the employes and the hours they work, which record is used in making out the pay rolls. The electrician's log is kept in the same way, except it shows the dynamos run and the output at the switchboard in kilowatts; also the thermometer, barometer and weather reports. There is also a maintenance log, but it is made up by the storekeeper from the time cards and shop orders. A shop order is taken out for every piece of maintenance or investment. These shop orders are numbered and mention the ledger account they are to be charged to. The estimates for the fiscal year are given by the ledger account, so by taking the totals of the shop orders belonging to any ledger account, we can tell how much is spent at any time and how much is left for the rest of the year. The numbers and descriptions of these orders are given to the foremen who have any work to do on them, and they make out what are called "trouble sheets" for every piece of work. These are made in duplicate or triplicate, giving the shop order number, so the time cards of the men working on the job will be charged to the proper account. As an illustration we will follow out a piece of work. The electrician on watch receives a telephone message that the lamp pole on the corner of Pine and Sixth streets is to be moved on account of a large radius of the curb being put in. In his record this lamp is given as a crane lamp, and knowing that the shifting of the pole will place the lamp back from one street, he makes his sheet read, "Move pole and change lamp to a mast arm at Pine and Sixth." Shop order No. 1305 is for alterations of lines due to foreign improvement, so he makes his trouble sheet in triplicate, giving number 1305, and charges it to damage and not to maintenance or investment. True, it goes to maintenance in the end, but it is kept on our books as a separate item. These trouble sheets are white and yellow sheets blocked alternately. A white sheet is retained for the purpose of informing the succeeding electrician what is being taken care of and what is not. The other sheets are given, one to the foreman who does the work, the other to the lamp man to correct his records. The foreman receiving the order finds he will have to set a longer pole, so makes out a requisition on the storekeeper for a 45-foot pole and mast arm complete, giving the number 1305 on the requisition. The time cards of his men for that day are marked with the number 1305 for four hours. The storekeeper charges the shop order, number 1305, with the material from the requisition and the time from the cards. At the end of the month the shop order goes to the office where the items are charged to the proper accounts.

I follow this through in detail myself. If I have a new location to go in, I make out the yellow and white sheets in the same way. We have three electricians for eight hours each, one following the other. The white sheet always indicate to each what has been done. If the yellow sheet is there with the white sheet, he knows what has not been attended to and sends someone out to see to it. If, on the other hand, the yellow sheet has come back with the details of what has been done on it, he knows the work is complete.

The above is an outline of the rules and records for a City Electrician's office, but there is another class of records which are very important, and they are the Engineering records. These consist of all details, tables and data concerning the electrical government which cannot be included in the field records. Besides specifications of apparatus and supplies, it should include their indices to articles and papers and letters, or the articles themselves which refer to all the subjects you have to deal with. Don't try to minimize them. By keeping watch of all these subjects, you will be able to carry out a suggestion I made in last year's address, which was written especially for small cities. Elevate the position you hold and make its importance felt by the people. By manfully doing your whole duty you will interest the public in your welfare, and you will find that interest your most powerful protection. In cities of from three to five thousand inhabitants you will find that one man is general engineer of the entire city, city electrician, engineer and superintendent of the water works, and it was for his benefit that this paper was written. Speaking of the public interest being your most powerful protection, I may say that I had an experience of this during the past year. I asked for a lineman and was given a ward bum from the 'Steenth Ward. He could shave one pole a day, while a lineman could shave six or eight. The Commission and the politicians wanted me to keep that man, but I did not do it. I did not fear but that the better class of people would back me up in this action. It was hard work, but I stuck to that plan. I was out of office six months, and they sent for me to come back again.

Besides these specifications and indices, there is one accessory I wish to call your attention to. In your regular routine work you have some duties which have to be attended to only a few times during the year. I use a "tickler" for this. It is a small card receptacle divided into the months, with the present month sub-divided into days. These divisions are made by guide cards which are taken out of the front of the case and placed at the back as the days go by, thus placing before me each day any special thing I wish attended to.

Probably you all have systems of this kind, simply a card index in the desk. The guide cards are numbered by the month and the small cards by the day. When I want to make a note, I take a slip of paper and slip it in with the card for any particular day. When I come to that day I find the slip. Then I have a little book with detachable leaves which I carry in my pocket. When I meet a person who wishes me to have a light put in somewhere, or some improvement made, I jot it down and put the loose leaf in its right place in the card case, and at the proper time the matter is attended to.

RULES AND REGULATIONS FOR THE CONSTRUCTION AND MAINTENANCE OF ELECTRICAL WIRES.

Wires are divided into two classes:

I. Those for telegraph, telephone and signalling purposes.

II. Those for electric light and power purposes.

These are again classified as overhead and underground.

OVERHEAD.

1. Two pole lines bearing the same class of wires shall not be erected in the same street, avenue or alley, nor shall two pole lines of either class be erected on the same side of any street, avenue or alley. Whenever possible, all pole lines shall be built in alleys.

2. Poles shall be set near to and within the curb and not nearer than ten feet from any hydrant. They must be at least five feet in the ground for a thirty foot pole, and not less than one-seventh of their length for longer poles. Where pole lines intersect, there must be a pole used in common, when so required, unless otherwise specified in the permit.

3. All poles now standing, or hereafter erected, shall be branded or stamped with the name or initials of the company owning them. Each group of cross arms, or where necessary the support of a single wire of different ownership must be distinguished by some characteristic mark or fastening, otherwise the owner of the pole will be held responsible.

4. All poles erected in conspicuous places must be of such weight and dimensions and be painted such a color as may be approved by the Public Lighting Commission.

5. Each line of poles must be run on one side of the street only unless special permission is given to cross.

6. Cross arms must be at least twenty-four inches apart, strengthened by braces and designated by some characteristic mark if belonging to a company other than the one owning the poles. In class 1, pins must be at least twelve inches apart, and inside pins twenty-eight inches; in class 2, inside pins thirty inches; all others fourteen inches. Where wires under class 2 are taken from the main line at any angle, the outside pins must be steel or cored, or an iron guard placed between the outside pin and the end of the arm.

7. All wires must be fastened upon poles or other fixtures with glass, porcelain or other insulators approved by the Commission stretched properly and fastened with a tie of the same kind of wire or other fastening approved by the Commission. Lines of wires at intersections must not pass through each other, but must be either above or below, preferably class 2 above those of class 1. Upon all poles the lowest point in the wires suspended from them shall not be less than twenty-five feet from the ground.

All wires which would naturally pass within four inches of any pole, building or other object, must be attached to the same and insulated therefrom. All wires strung on house tops must be at least seven feet from flat and one foot from the ridge of pitched roofs. The permit must be countersigned by the occupant on whose building it is desired to fasten the wires.

9. Where wires of class 2 are trained on the same poles as class 1 the different potentials must be at least four feet apart. If only one arm is needed, the two classes should be separated, one on each side of the pole. No wire can be trained on brackets or knobs. Guys must be in proportion to the strain and not smaller than No. 8 Birmingham guage and all angles must be guyed, the guys insulated, and where there are more than four wires in the line, head guys must be used.

10. Every line, pole or fixture must be kept in thorough order and repair, in conformity with these rules and regulations in every case, where possible, under the general permit for repairs, (rule 16) upon penalty of forfeiture of all permits not acted upon and a refusal to grant new permits until the rule is complied with, but no additional poles or wires can be erected under cover of repairs nor shall any route or location be changed without a permit.

11. All wires or current carrying conductors, poles, guys or apparatus belonging to any person, firm or corporation that may be found dangerous to life or property or intruding on the rights of citizens or other corporations must be remedied by the owners thereof when notified. This applies to any damage to sewers, conduits, sables, gas or waterpipes by electrolysis or otherwise.

12. All wires of class 2 must be secured to insulating fastenings and covered with an insulation not easily abraded and waterproof and approved by the Commission. Whenever the insulation becomes impaired, it must be renewed immediately.

13. All connections with pole lines for service in either class must be made at right angles to the line where possible, and connections to buildings shall be run straight across to buildings, where possible, and then down and the insulation must be preserved throughout the entire circuit.

14. No electrical conductor shall be erected, maintained or placed overhead or underground without a permit in writing therefor being first obtained from the Public Lighting Commission, and before such permit is issued the person, corporation or company wishing to place or maintain said wires shall make application to said Commission in writing stating the size of said wire, the purpose for which it is intended and the character of the current is intended to convey, also a plan or description showing the position to be occupied and general arrangement.

15. All owners are authorized and directed to make necessary repairs to their lines of conductors, and permits for such repairs will be granted by the Commission upon application. In all cases emergency repairs may be made without permit, but a report of such repairs is to be forwarded within twenty-four (24) hours after the making of the repairs and a regular permit taken out at that time.

16. Where notice has been given of underground accommodations and the notice of time required by law has elapsed, companies owning or operating overhead lines are not authorized to make any repairs or connections, or to go upon the poles bearing such wires for any purpose whatever except to remove said lines in conformity with the direction of said Commission.

17. The amount of wire allowed for service connection from a pole to a building shall not exceed 130 feet between the supports, except by special permit.

18. The person, firm or corporation owning or controlling poles in any street, alley or public place must allow the same to be used by other persons, firms or corporations operating wires, cables or conductors for electrical service when authorized to do so by the Commission on tender

of proper compensation to be determined by agreement between the parties interested. If the present capacity is not sufficient for both lines and unless otherwise agreed upon between them the party desiring accommodation may rebuild the line of poles and rent contracts to the owners of the previously existing lines at terms to be agreed upon between the parties. In default of any agreement between the parties interested, the matter may be referred to the Public Lighting Commission for arbitration and their decision is to be final.

19. Any person, firm or corporation in accepting any permit from the Public Lighting Commission hereby binds himself or themselves to the acceptance of any provisions specified in any rule established or to be established by the Commission, unless it is specifically excepted in the permit. The Public Lighting Commission reserves the right to alter or add to these rules as they may desire at any time.

20. It shall be the duty of the Public Lighting Commission to turn all money received under this ordinance into the Public Lighting fund.

21. No person, firm or corporation shall train wires, erect poles, build conduits, manholes, hand-holes or make any alterations whatever in electric line equipment without first notifying this Commission in writing, giving a description with diagram of the proposed work, allowing ample opportunity for inspection, and receiving from said Commission a written permit to do the work described. All such work, equipment, alteration or addition shall be done under the supervision of and subject to the inspection of said Commission and upon finding the work to be done according to such rules and regulations, the Commission shall so certify and place the record thereof on its books, maps, cards or diagrams; but no such equipment shall be used by anyone until such certificate shall have been given by said Commission in conformity therewith.

22. Any firm or corporation who shall make contact to poles or other property of the Public Lighting Commission, Police or Fire Commissions without having obtained a permit for the same from the Public Lighting Commission, shall pay a fine of three dollars for each such unauthorized contact and no further permits shall be granted to said person, firm or corporation until the aforesaid fine or fines are paid.

23. Owners of lines of poles or of buildings shall remove therefrom all dead wire or wires fastened thereto in violation of these rules, when notified to do so by the Public Lighting Commission within a reasonable time to be expressed in the notice; on failure to do so the Public Lighting Commission will proceed to remove the same.

Many details can be added to these rules, for instance rule 8 can include a clause forbidding the interference with wires by builders with scaffolding, ladders, etc. Rule 10 could have a clause against intoxicated persons working on lines. Rule 11 might be increased to include repairs to city property, such as sidewalks, curbs and pavements, trees water pipes, etc. Sections could also be inserted defining details of construction, what shall be termed dead wires, space required for city wires, trimming of trees, limits of leakage from railway tracks to water pipes and other such subjects.

REPORT OF COMMITTEE ON PARK IMPROVEMENTS AND MAINTENANCE.

BY G. A. PARKER, HARTFORD, CONN.

When I realize that forty-five of the largest cities in the United States and Canada are united in this Association by their officers who have charge of the doing of things and that the municipal work of fourteen million of people is here represented, I wish some one worthy of the occasion might make this report and so bring before you the value of parks and the method of their successful management. I have been met so often with a feeling among the hard-fisted man of business that parks are a sort of a side show in municipal life, very nice, pretty and pleasant, but not essential, even if desirable, yet may be accepted if obtained without too much trouble. That cities have in the past and can in the future do without them. But I so thoroughly believe they are such an absolute necessity to municipal health and growth of children into strong manhood and womanhood that I would that I could impress that feeling into the very heart of every member of this Association, where I am sure it would bring forth fruit in a hundred folds, for you occupy position where all the fruit you can bear will be used by the people you serve. Although park work is often put to one side as the least of the city functions, nevertheless it is assuming large proportions, for not counting the small parks and squares, counting nothing under one acre, the cities represented here today have five hundred and thirty-six parks, containing forty-one thousand five hundred and eleven acres, costing last year over six million of dollars for their care and improvement, an average of less than forty-three cents per capita per year, less than one cent per week per person. There is no function of the cities' work of such vital importance on which such a small sum is expended. It ought to be doubled.

The tendency of the last year has been in two directions, first, a decided and popular movement towards multiplying the number of play grounds and small parks, the need of which has at last been recognized. Secondly, the inauguration of a complete system of parks, connecting them with park ways, considering the city and its suburbs as a unit and developing that unit by a well thought out plan. The first of these movements began about five years ago, the second about ten years ago, but the work along these lines does not attract at present so much public attention, yet is fully as important. At least, it was about these times when they became well-defined purposes, although they were discussed and experimentally carried out some years before. The larger cities are taking up with all seriousness the play grounds question and New York, Chicago and Boston are making rapid progress, others are preparing to follow. In the work of developing the city as a whole, Washington, Ottawa, Chicago, Providence, Seattle and San Francisco are giving much attention either by the appointment of commission. the employment of experts and discussion in the press. Several other cities have got so far as the newspaper stage. I leave Boston out of this list, for she is rapidly perfecting her plan and has much of the work so far completed, that she stands in a class by herself. Although New York is doing a wonderfully good work in her play grounds and public baths, in addition to her general park work, yet she seems to be neglecting entirely, the development of her territory as a unit, and it is a pity that she is, for she has opportunities in land and water, in her hills and shore, which is not excelled by any city in America. In saying this, I do not forget her work in The Bronx or the extension of Riverside Drive and the other work she is doing and doing well. The thought I want to convey is, that New York has not yet, at least, it has not manifested itself on the surface, taken serious thought of how her two hundred thousand acres are to be divided into private and public grounds and how her public grounds are to be sub-divided into streets, park ways, large parks, small parks, play grounds, sites for public buildings and other public purposes. Of course, she is doing an immense amount of all this work, but she does it locally by sections and not as a whole. It is a tremendous proposition to take this matter up seriously as a unit, but we expect tremendous thing of New York and we know that whenever she does do it, she will do it in such a way that every other city will find the path cut out when they come to solve a similar problem.

Your committee during the last year did not lose sight of the fact that an annual report would be expected of them at this time, and such information as came their way was jotted down that it might be used. On September 28th they sent out a list of ten questions to each member of the Association, and we are pleased to say that the response to our letter has been very general and the information received quite satisfactory. From these replies we have been able to get the names and areas of the parks and squares of thirty-eight cities, represented in this Association and to report that the improvements made in the five hundred and thirty-six parks containing forty-one thousand five hundred and eleven acres have been on the whole quite general and of more importance than usual. Only a comparative small percentage of the total park area is maintained in first-class condition, that is, with short grass, the walks and roads kept up and the trees and plantings in good order. In the heart of the city the parks and squares are almost always lighted, the cost being usually paid out of park funds, although not always. In most of the cities the parks are policed by regular city police, the tendency seeming to be in favor of this method. A few, however, are policed by special policemen and there are those who advocate this method very strongly, urging that the man who is an ideal policeman for general purposes, is not suitable for a park policeman, for what is required of him in parks is very different than the requirements of the street. The policeman as a rule limits his interest to those who have actually committed an offense. With the park policeman their duty is more to prevent disagreeable actions and disturbances to visitors. They are there more as guides than to arrest criminals, and it would seem as if the park interest was better served with policemen selected who are adapted to the greater needs of the park which certainly many of the city police are not.

There seems to be an ever-increasing call for the introduction of features and apparatus for the entertainment of the people. Some of the letters referred to the fact that the amusement parks of the street railroad companies are decreasing in attendance to the municipal parks and one goes so far as to say that when the street railroad parks are opened, the city parks are nearly deserted, but when they are closed the city parks have a goodly attendance of visitors. During the last few months, we have indulged our weakness for census work by making a canvass of the railroad parks throughout the United States. We find there are over four hundred of them, nine-tenths of which have been opened within the last five years, and their numbers are rapidly increasing. The work done in their development often is of the most superficial order with little thorough work. The artistic sense is often shocked, and they are usually cheap in every sense of the word, yet, they attract thousands of people and are increasing. They have many visitors and in some cities are used by the people to a much greater extent than the city parks. Now, it seems a reasonable conclusion to suppose that this has been because they satisfy the needs of the people as the higher, better grade and more artistic parks do not. There is not time to go into this discussion as fully as I would like, but I do not believe the reason to be from a lack of artistic instinct in the people. They appreciate the higher art and believe in it, but they are hungry for that which gives variety to the monotony of their daily lives. The introduction of machinery in manufacturing life, the specializing of nearly everything relating to mercantile life, and the monotony of the laborer's life tends to atrophy in a large number of people who live in cities. To escape this fate they must have variety and change which they seek greedily, and the higher, better, more artistic scenic park is left to those who are weary from variety and not from monotony. It is like people who take great satisfaction in the furnishing of an elegant dining room with its table spread with snow-white linen, and set with silver and cut glass, but will leave it all and go into the kitchen or even to the swill-barrel if only there can be found the food which they must have or die. Now, what is it that the people find at the railroad parks and which is wanted in the highly developed scenic parks? I will summarize it all by saying that the people, the working people, the common people, whom Abe Lincon said the Lord must love for he had so many of them, when they go out for recreation they are hungry for something to do or something doing. To those whose work is monotonous, that is doing the same thing over and over again day after day, activity is absolutely necessary to bring a change into the working of their brains. Their minds become, as it were, leathery and difficult to receive impressions and only action will impress them. The quiet, restful naturalistic parks make but little impression on their feelings and they take greater pleasure in having their feelings stirred, even though coarsely, than not to have them stirred at all. The city parks have something to learn in all this and so supply the needs of its people. If the plan adopted for the park development is that which is so often adopted by the Olmsteds of having a circuit drive inside of which, can be the large, beautiful meadows and the plantings and wood-lots, and on the outer borders of which can be flowers, the buildings, the merry-go-rounds and the playgrounds and all that interests the people whether they are old or young. I would not lessen one whit the beautiful naturalistic parks, but I would find some nook or corner ample in area and convenient to the people where those who desire the activities of the railroad parks can have them in abundance. This also would be well for the railroads themselves as they would receive as much income from travel and not have the trouble of maintaining the parks. Would the people care for this change? There are indications that they would not unless the park commissioners would enter seriously into the consideration of this factor of the parks' work and furnish the variety needed. Commissioner Young of Brooklyn wanted to convert Coney Island into a seashore park, but he was met with a strong demonstration of the people, who preferred the present life and activity, the gaw-gaws and frivolties and excitements of its present conditions, to the rules and regulations of the park commissioners. All too often have the rules and regulations of the park commissioners been considered in light of what was good for the park itself, the grass, the flowers, the trees, and not what was good for the people who visited them. Here is a problem which requires a large study, the solution of which does not seem as yet to be in sight.

The new work planned for by the cities of this continent is very great. The last few years have been so prosperous that the cities have ventured and are venturing upon expenses which ten years ago would not have been considered. New York is planning to spend several million dollars on its small parks and playgrounds. The Metropolitan Park Commission has been authorized to expend $3,000,000 for the addition and improvements of their territory covering a term of lands. Cincinnati has $1,000,000 to spend for additional parks, and the different park boards of Chicago have from $1,000,000 to $1,500,000 each to spend for parks and playgrounds. San Francisco last month voted over a million for increasing its parks and playgrounds, and the park question in the smaller cities is making great headway. Everywhere there is activity and fully $10,000,000 has been voted for increasing the park work during the next few years.

We would like now to call your attention to results accomplished by separate cities, and would mention first New York city, for there we find the greatest advancement. And also because what is done or not done there effects more people and has greater influence throughout the country than anywhere else, besides they are forced by circumstances to solve many problems in advance of other American cities. Futhermore, during the last twenty years, I have been so situated that I could easily visit the New York parks and become familiar with their physical characteristics and their methods of development and maintenance and I never in all that time went there without visiting one or several of the parks. Then I have a complete set of their park reports and am a reader, so far as park work is concerned, of "The City Record." From out of all this mass of information, the accumulation of years, I have every reason to congratulate, not only New York, but the whole country, on their work of last year, not only as to the construction of new parks and playgrounds, but also in the improvement and maintenance of the old parks. Central Park and Prospect Park have long been the pride, not only of New York and Brooklyn, but of the whole country and have always received a high degree of care and attention, but many of the other parks have been sadly neglected in maintenance, and improved with such interminable slowness that their completion could not be prophesied. Imagine, if you will, the pleasure and surprise to know that New York has roused herself and has gone forward during the last year with her park work at a rate unsurpassed by any city at any time. She has constructed a forty-acre park in as many days which illustrates the vigor of her work, and every one of her eighty odd parks has received increased attention and a better degree of maintenance, and many of them have been so greatly advanced in their improvements that their completion seems in sight, and when it is realized that all this gain has taken place with largely the same employees as have worked in the parks for years and that the gain has been altogether greater than the additional expense, one will realize that it has come about by a more masterful hand and a stronger energizing spirit that has given a quickening element to all persons connected with them. This is the great lesson that New York has for us this year, that park work cannot rise above the capacity of the administration, and that it will always respond to meet whatever is expected of it from those in authority. There are many other lessons in park construction which might be learned during this last years' work of this great city, but this one lesson seems to overshadow all the others, not a new lesson by any means, one that the world has learned over and over again; yet it is always helpful and gives inspiration. We all admire Colonel Waring's administration of the Street Department, we can now as justly give our admiration to Messrs. Wilcox, Eustis and Young, the Park Commissioners of New York City. There is not time to go into details as much as I would like, but there is one measure by which is shown this advance made; that is, in the rank which New York now has in her park work when compared with other cities.

New York is a great city, almost incomprehensible. We are so accustomed to ranking her first in every line of work, that it is hard to understand that she may have stood low in rank in some things. In everything relating to mass, she ranks first; first in population, in territory, in wealth, in business, in commerce, in number of acres of parks and the moneys spent upon them, but when it comes to the quality of her work and its ratio to her population and valuation, she is not always first. While New York's population so far exceeds all other American cities, that she really stands in a class by herself, yet for comparison's sake it is customary to measure her work with that of other great cities, considering as such those which exceed 100,000 in population. By the census of 1900 there are thirty-eight such cities in the United States. Let us see how she compares with them as to parks. As I have said, she ranks first in number of acres of park land and in the total sums expended upon them, but if we were to consider as Greater Boston an area equal to the area of Greater New York, then such Greater Boston would have nearly double the acres of park land that New York has and would make New York rank second. In per cent. of the total area of New York which is set aside for park purposes, New York ranks twenty-third and in the number of people to one acre of parks she is twenty-seventh. In per capita cost of maintenance of parks, she is ninth, in the average cost of maintenance of parks per acre she is sixth, in the per cent. of her total income used for park purposes, she is twenty-second. This was her rank three years ago. Unfortunately for me in making this comparison, the returns of the cities have not come in for two years ago and not more than half of them for last year. I usually get them by

September; yet a sufficient number has come to satisfy me that New York has gone forward by leaps and bounds and her work this year will place her nearly, if not quite, at the head of the list in park development and maintenance, while three years ago her average rank was in the twenty's. To those who believe in parks and playgrounds, that they are for the people, I do not know of any event during the last year in the park world which will give greater satisfaction than the advancement of New York City during the year since our last meeting.

There is another city which I desire especially to call your attention to and that is Washington. A city standing alone in its relationship to the American people, and, for its advancement and improvement we are all responsible for, and ought to be interested in. It has now grown beyond its original plan and is spreading out over the remainder of the district. It is sorely in need for a well-balanced plan to guide its growth. This need has been felt for several years by those having its interests at heart and three years ago the McMillan Park Commission, so called, was appointed. This Commission consisted of the best men this country afforded. In its personnel there was Burnham of Chicago—Olmsted of Boston, McKim of McKim, Mead & White of New York and St. Gaudens. They studied the problem very carefully for two years, and presented a report, with tentative plan that I believe has met with universal praise from the people and the press. Last year Congress took this matter up and without discussing the worthiness or the unworthiness of the Commission, or any thing connected with what Washington should be, killed the whole matter in Committee because this commission has spent forty-eight thousand dollars in their preparatory work, an unjust and unworthy proceeding, largely owing to the action of one man who lives out this way somewhere and who tries to make us believe that he is the Bull-Dog of the Treasury. I am willing to grant the first part of the title. Now, Washington depends upon the action of Congress, and Congress is made up of men whom you and I vote for, so thoroughly do I believe in the need of a well-directed and continuous effort for the development of Washington and in the fulfillment of the plans suggested, which are in harmony with the original plan of L'Enfant and Washington, that I am going to ask this Association at this time to pass the following resolution:

RESOLUTION.

Resolved: That the American Society of Municipal Improvement is in hearty accord with the plans and suggestions for the development of Washington of the Commission appointed by Chairman McMillan of the District of Columbia Committee, commonly known as the Park Commissioners, or of some similar plan in harmony with the original plan of L'En-

Fant and President Washington. And, that our purpose and influence may be known and exerted in all legitimate ways that a committee of five shall be appointed by the incoming President, of which he shall be one, to have full power to represent our Society in this matter and report at our next meeting.

It is especially fitting that we should do this at this time, then again, Canada is making most efficient plans for the development of its Capital City, Ottawa. Can the United States afford to see its sister country making rapid strife in the unifying and beautifying of its capital and she remain careless? Both countries are largely represented in our membership. Glad are we that it is so. Let us take equal interest in the development of both capitals and may our influence be for the betterment of all cities.

I wish every one of you would read the reports of the McMillan Commission on the improvement of Washington and Todd's report on the improvement of Ottawa.

MR. LEWIS: I would like to second the resolution moved by Mr. Parker. Perhaps the Society is on delicate ground when it attempts to urge upon Congress or any legislative body any certain policy. Those who are familiar with Washington, however, must feel almost inspired when they study the admirable and far-reaching plans formed a century ago by Major Norfolk. These plans lay dormant for a long time, but were finally put in force by a man who was called one of the lowest type of political boss,. a man to whom Washington owes a great deal—Shepard. While he may have misused some of the funds, it has never been proven, and certainly he has laid Washington under a debt of gratitude to him. You have in this city a remarkable instance of foresight and wisdom in planning the central portion of this town. I was amazed to find that the plan of the central square mile of the City of Indianapolis was decided upon and laid out nearly a century ago, when this was a very small settlement in 1819 or 1820. It was laid out by the engineer who had been associated, I am told, with the man who carried out the original plans for Washington. The system is easily recognizable when we compare this plan with the Washington plan. There is a model in the Library of Congress, which many of you may have seen, a magnificent model of Washington as it exists to-day, showing almost every building in the city, and beside it a plat showing the plans of the Park Commissioner. Burnham, Olmstead, Bernard, St. Gaudins, are names to conjure with, and it seems almost impossible that a report from these men should have been turned down because they wanted to spend a paltry sum. I think it is proper to adopt the report introduced by Mr. Parker and present it in a discreet way to the Federal authorities.

A motion was made and seconded that the resolution be adopted. The motion was carried by a unanimous vote.

PRESIDENT RUST: I think there are some members who wish to continue the discussion of Mr. Folwell's paper.

MR. LEWIS: I regret very much that there was no opportunity for discussion when the paper was read, and probably a number of the members of the Society would be glad to discuss it. I can only express my appreciation of the paper and the painstaking manner in which it was prepared. The facts brought out in it were surprising. When we find that a new sewer is actually under pressure with a head of water before there is a house connection, I think it is pretty clear that many of our engineers are going it blind and do not begin to appreciate the importance of making their sewers impervious to ground water. He stated in the first part of his paper that his remarks applied only to a separate system of sewers. I can hardly believe it possible that all the sewers of which he gives data as to leakage were designed as separate systems only.

It seems that in our great cities along the seaboard, where sewage disposal is a comparatively simple matter, where combined sewers have been used for years, I think there is a disposition to make a sort of fetich of the combined system and think nothing else is applicable. In the City of New York there is an enormous area of 340 square miles. One of the boroughs contains 140 square miles. I find the engineers of these boroughs are designing their sewerage systems in the same old way, as combined sewers. With a suburban development, with low values, it is going to be a very serious problem whether or not the propertv can stand assessments for the enormous sums required. There is also a very serious complication which I think will arise with the State Board of Health, as to whether the sewage can be discharged into some of our tidal streams. I have in mind what was formerly the Village of Flushing. They have contemplated a sewer passing through a section entirely undeveloped, and I am at a loss to understand how, under our system of assessments, they can pay the assessment in one lump for a sewer eight feet nine inches in diameter, when the charter of the city does not allow an assessment which is more than a certain percentage of the assessed value of the real estate. I have tried to convince the engineers that it would be far better to adopt a separate system. I was not prepared to discuss the paper, and I did not intend to. I feel, however, there is discussion latent in the room which can be brought out now that an opportunity is offered.

Mr. Adam: I remember an instance that was quoted of a sewer in St. Louis. It was eight feet in diameter, was constructed on the combined system, and the actual amount of sewage conducted through that sewer did not fill a ten-inch pipe. We are probably wandering away from the subject of keeping out the ground water. In former years in Newark the inverts at the bottom of the sewers were built without any cement. That meant carrying a great deal of ground water in addition to the sewerage. The same course was pursued in Frankfort-on-the-Main. They found that their sewers as constructed carried a great deal of ground water, and it was necessary to reconstruct them. Newark will soon confront a great financial problem if that great relief sewer is ever constructed. The intention is that all the municipalities for about thirty miles will be assessed for maintenance and cost in comparison to the number of gallons of water discharged into the intercepting sewer. The City of Newark discharges about forty-eight million gallons to-day along the whole system, and the consumption of water is only about twenty-five to twenty-eight millons gallons under normal conditions. That means that the vast difference is ground water. They are going to tax the city of Newark in the future for the amount of water turned into that sewer. It probably means reconstruction, and in a certain measure abandoning the idea of the combined system and introducing the separate system in many localities. The time is coming when the sewage may have to be treated, and then comes the difficulty of having a larger quantity of water to treat than the actual amount of sewage will produce.

MR. SHERRERD: Mr. Folwell has shown the immense amount of ground water that enters many sewers. His calculations show that more water sometimes enters through the ground than is furnished by flush water. It seems to me it is worth while to consider whether such sewers should be provided with a flush tank.

MR. HATTON: I was very much pleased with Mr. Folwell's paper. I am on the unpopular side of the question, however; I cannot agree with him altogether about the perviousness of sewers. His paper, as I take it, deals particularly with the perviousness of sewer joints in separate systems. A single system of sewers is usually built to-day in our smaller towns and villages. Very few of the larger cities at the present time have separate systems of sewers. The sewage is discharged into the nearest available water course, so I take it his paper relates only to the sewage systems of smaller towns and cities.

Now the question is whether any separate system designed is perfect unless it lowers the ground or sub-soil water of that locality. Isn't that one of the prime reasons for constructing a separate system of sewers? If the sewage must be treated by purification in any way, it seems the principal question to decide is whether to take in the undeground water, or whether to exclude it, is the difference between the cost of the disposal field or purification plant by reason of treating that underground water, and the cost of constructing sub-drains underneath the system and carrying the water to the nearest available outlet. I think that question should largely determine the engineer's mind in that respect. If the sewage must be pumped, it is certainly just as necessary to pump the underground water as it is the sewage. The gentleman from East Orange told us yesterday with what great care and expense he had constructed a main sewer through a locality where the ground water stood on the surface. Is it not a fact that when that locality is to be built upon by human habitations it is just as necessary to drain that sub-soil water as it is to carry off the sewage? Is that wet ground fit for human habitations unless you lower the water? Won't that East Orange engineer in a few years have to design some system by which these sub-drains shall be taken care of. When I first started out many years ago, when I wrote out my first specifications for a sewage system I copied from the old and rewnowned engineers of the country. But I wanted to be a little better, and my sepcifications required absolutely impervious joints. The contractor who was the successful bidder on that contract didn't think I meant what I said in the specifications until after he had begun his work, when he found to his great sorrow I did mean it, and the expense to him was very much greater than he anticipated. The next contract that was let under the same specifications showed the cost to be fifteen to twenty per cent. more than it had been before, or that had usually been paid in that locality for that class of work. I soon learned that there was a point where the engineer should in his specifications define just exactly what kind of joint should be made, and whether it was to be impervious to water, or impervious to sand, gravel, clay and such things only.

Mr. Folwell stated that in a city of 20,000 inhabitants the increased cost for enlarged outlet sewers, by reason of allowing pervious joints, would probably be five thousand dollars. In order to get a tight sewer through a water-logged soil, it is absolutely necessary to build sub-drains to carry off the water underneath the main sewer. He did not state that the construction of these subdrains in that size sewer system would be much greater than five thousand dollars, and anyone who constructs a sewer system and attempts to construct a system of sub-drains under that main system, will find to his sorrow and regret that it is a very difficult matter to keep the sub-drain flowing continuously during the time of construction. They get filled up with all sorts of sand, mud, leaves and pieces of hemp, and occasionally with small tools, so that if you can run it two or three squares without having to tear it up or without having it stop, you will have better success than I have ever had.

I take it, too, that the paper was misleading to the younger engineers to some extent. I have seen specifications—several of them lately—which young engineers have written which provide for absolutely impervious joints, that, owing to the condition of the ground through which the system was to be built, were almost impossible to secure. They are adding to the expense of their clients and yet not getting results, and they will not get results.

Mr. Reimer: I think Mr. Hatton has offered a very fair challenge to our East Orange work, and I feel bound to state one or two circumstances, which possibly most of you do not know, in regard to the East Orange work. I think these circumstances will show to you and to Mr. Hatton that two things may be put together and worked and be done at a proper time, and done effectually and answer all the purposes for which the work was intended. It is a fact that we have built a separate system, and it was after we built this separate system that we undertook to build drains to carry off our storm water. There have been three sections of our territory built upon that place. The peculiar situation of East Orange is that it is divided. A portion of our surface water runs south, about half of it, and the other half runs north. We are bound by law to prevent our sewage from going into natural streams, but we may reach tide water if we can, and after our disposal plant had been accepted we bargained with the city to carry our sewage to tide water. We must keep the systems separate, for the storm water may go into natural streams, but the sewage must be kept out of it. The valley which has been spoken of is not in a fit condition for human habitation. It is low ground in which the cattle that pasture there sometimes get mired. We are in a position to build a storm water sewer which will drain this territory, and drain it thoroughy, and when the proper time comes we will undoubtedly do so. When that time comes we will be able to assess the benefits on the territory that is to be drained. If we had endeavored to build on the combined plan twenty years ago we would have to build out outlets to tide water to drain the whole territory. This would have cost five million dollars instead of eight hundred thousand which it did cost. Under our present system our population has doubled, and to-day we are planning for the extension of our storm water systems and drainage systems by two or three different routes. In that way we expect to leave plenty of room for the infiltration of water from the ground. We don't care how much that fills up or how much it carries. We expect the water from the ground will be taken into those sewers, and we don't expect to make them tight.

MR. FOLWELL: I am sorry Mr. Hatton did not comprehend the tenor of my paper, and fearing that some others have done the same, I wish to make a few remarks. I do not consider it possible to get tight sewers with the present way of making joints. I don't believe you can get them under present circumstances. Mr. Reimer has been unusually fortunate in gettting tight sewers by his methods.

MR. TILLSON: It seems to me in the discussion of this subject of the impervious sewers one point has been lost sight of that is important. My first experience in the separate system sewage was in Memphis in 1880, under Col. Waring. There we did our utmost to get sewers that were perfectly tight. The idea was not altogether to keep the ground water out, but to keep the sewage in. The great trouble down there had been that for lack of sewers the ground was thoroughly permeated with the drainage from cesspools, as the entire city of thirty thousand people was almost all furnished with cesspools at that time. The remark of Mr. Hatton that one of the objects of the separate system is to take the ground water, I think is wrong. I don't think that is the province of the separate system. I think the province of the separate system is to dispose of the sewage of houses. If it is necessary to take care of storm water the tiling should be laid without any excessive expense.

Now, as to the possibility of getting tile sewers tight, I should like to give some experience I had in Kalamazoo, Michigan, in 1881. The engineer who was with me had been in Memphis also, and we were working out Col. Waring's ideas. We laid one ten-inch pipe about half a mile through quicksand, where the water was probably two feet above the grade line of the pipe. When that was constructed, at the lower end of the pipe there was a stream of water coming out not larger than my two fingers. I was a young engineer then, and like Mr. Hatton, I was anxious to have the work done first-class. I saw every pipe that was laid myself. The specifications called for all water to be kept out of the pipes while it was being constructed, and it was. We had a pump at the forward end so that the water in the space where the pipe was laid was kept below the grade level. The joints were made first by caulking them with oakum, and then having the man caulking the joints, by using rubber gloves, press the cement into the joints after the oakum had been caulked in. Whenever I thought he was getting careless I would go down and examine them, and if it was not well done I had him do it over again. It did not take him long to get careful. We used neat Louisville cement, and did get practically an absolutely tight sewer, and the cost was not excessive.

It may be said that if water in the ground would flow in, that of itself would keep the sewage in and prevent the pollution of the ground. That may be so if the water is in the ground all the year round, but you might have ground water six months in the year and the other six months would be dry, and during those months the sewerage would be coming out through the joints.

Mr. McMath, St. Louis: I should like to make some reply to a statement made by Mr. Adam. He said in St. Louis a sewer eight feet in diameter was built, and the normal flow in that sewer could be acommodated by an eight-inch pipe. There were some gaugings made then that gave that result, and I don't doubt that those gaugings were correct. The sewer was built to drain a large area, and the alternative would have been to have an unsanitary open ditch along a street, or to build a sewer to carry off the storm water. That sewer was not too large to carry off the storm water in times of storm. When these gaugings were made the territory through which the sewer passed was comparatively undeveloped, and the flow which at that time a ten-inch pipe would have accommodated was largely ground or spring water which had gone into the sewer. If you will go to that same locality to-day you will find that the entire area is thickly built up, and a ten-inch capacity would be found very much too small. Consequently the situation, as we got it through the remark of Mr. Adam, going into our proceedings might lead to a disapprehension as to the method under which our sewer system was designed.

In regard to the different systems mentioned, I wish to say they all have their appropriate fields. When you come to our larger cities, where the length of the drainage lines is so great that open drains are not to be considered, you are compelled of necessity to resort to the combined system.

Mr. Reimer: The City of Orange joins us on the west, and they have within ten years completed a separate system by which their storm water is taken care of in large conduits and disposed of in their natural streams. At the same time these were being built there were laid, and the only cost in the construction of the sub-sewer was the cost of the pipe. That is working well to-day, the storm water going one way and the sanitary sewer taking the sewerage another way.

President Rust: The next report to be presented is the report of the Committee on Waterworks and Water Supply.

Mr. Sherrerd: We have no special report to make. The chairman of the committee has confined his energies to endeavoring to get papers on waterworks subjects for the Society, has succeeded in getting two and a promise of two others. They are not listed in the program, but the men who expected to prepare them promised to be here this afternoon. In lieu of a report from the committee I shall submit a paper on the construction of 60-inch reinforced conduits.

CONSTRUCTION OF REINFORCED 60-INCH CONCRETE CONDUITS.

MORRIS R. SHERRERD, NEWARK, N. J.

The City of Newark, N. J., has an abundant suply of excellent water derived by gravity from the Pequannock River, one of the tributaries of the Passaic. The watershed embraces 62 square miles situated in the northerly part of New Jersey about 25 miles distant from the city.

At least 75 per cent. of this watershed is of a rugged and mountainous nature, the entire territory so sparsely settled and such thorough methods adopted to prevent pollution, that the city is justly proud of being able to claim the best gravity water supply in the country, if not in the world.

The water is collected in four large impounding reservoirs, having a combined capacity of nine billion gallons, and is delivered by gravity to the city through two steel conduits, one 18 inches and one 42 inches in diameter. These works were built by the East Jersey Water Co. during 1890, 1891 and 1892 and were operated by that company until Sept., 1900, at which time they were taken over by Newark.

In the city itself there is very little reservoir capacity to furnish a supply of water in case of accident to the watershed conduits and as the two pipes are laid only 12 feet apart for their entire length of 22 miles, anything causing injury to one would be liable to affect the other. Hence, when Newark took the works from the East Jersey Water Co. immediate steps were taken to guard against any possible water famine resulting from accidents to these conduits, by building a large storage reservoir near the city. The advisability of additional reservoir capacity near the city and the advantage of an independent pipe line were clearly shown by the effect of the recent flood in the Passaic River Valley, when the swollen condition of a small trout stream, resulting from a continuous rainfall of 14 inches in thirty-six hours, made a washout under the two conduits now supplying the city, leaving them suspended for a distance of 35 feet. Only the fact that they were composed of steel pipes saved the city from a serious water famine.

The site selected for the new reservoir is a natural basin about one mile from the watershed conduits, and about seven miles from the city, the general route by way of the reservoir being somewhat more direct than by way of the original conduits. The work embraced in connection with the construction of this new reservoir required laying a mile of 60 inch steel supply pipe from the watershed conduits to the reservoir; the building of a seven foot outlet tunnel 3,000 feet long, and the laying of about seven miles of 60 inch steel pipe from the tunnel to the city. The work has been under contract for about two years and is nearing completion.

The reservoir basin is about 5,000 feet long, from 1,000 to 1,500 feet wide, and will have a capacity of 700 million gallons. Incidentally it is desired to secure from the new reservoir all the possible benefits from the storage of water including the advantage of sedimentation, and to attain this end with the configuration of the ground, it was necessary to plan for 4,000 feet of single 5 ft. pipe, and 1,500 ft. of double 5 ft. pipe along the bottom of the reservoir. These pipes or conduits inside the basin are being built of concrete reinforced with an expanded metal core.

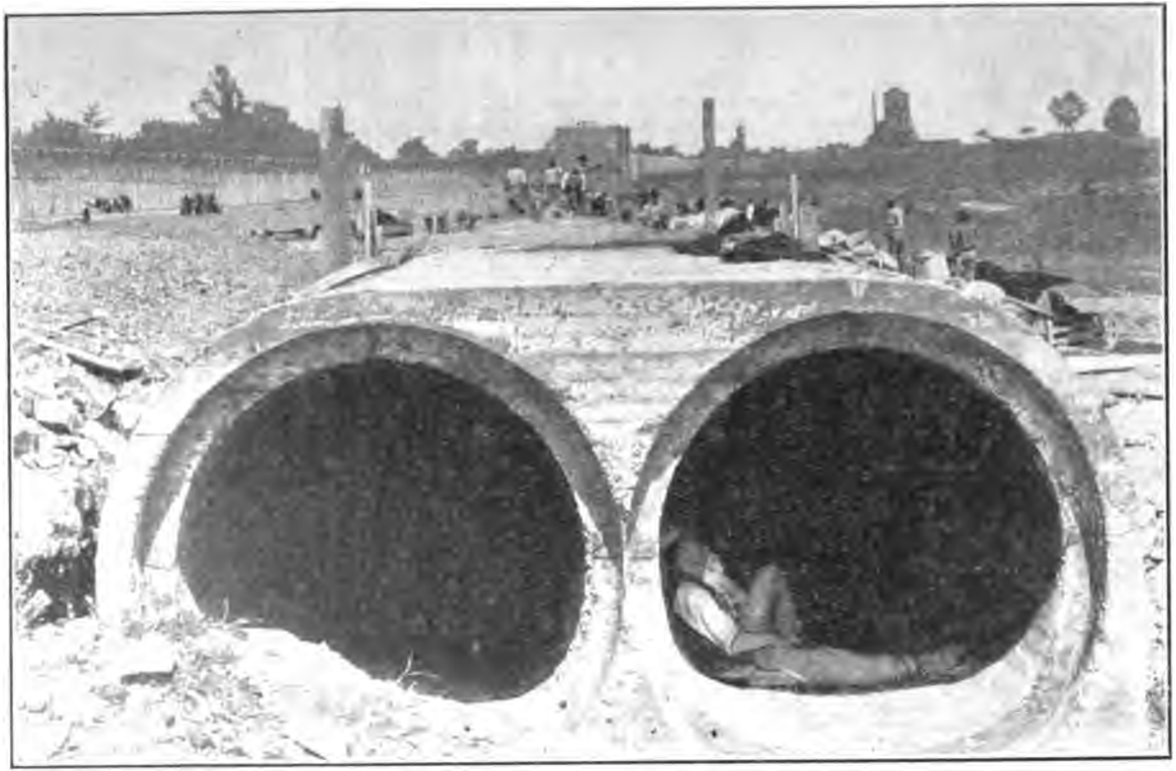
The section of the bore of the conduits is not far from a circle 5 ft. in diameter, and the thickness of the walls is 10 inches. The concrete is mixed in the proportion of one of Portland cement, two of sand and five of 1½ inch stone, and the expanded metal is No. 10 steel with 3 inch mesh. In general, in operating the reservoir, the head of water in the conduits will be balanced by that outside; but at times the basin may be full and the conduits empty, or the conduits may be run under a head with the basin empty. The greatest head possible will be 45 feet.

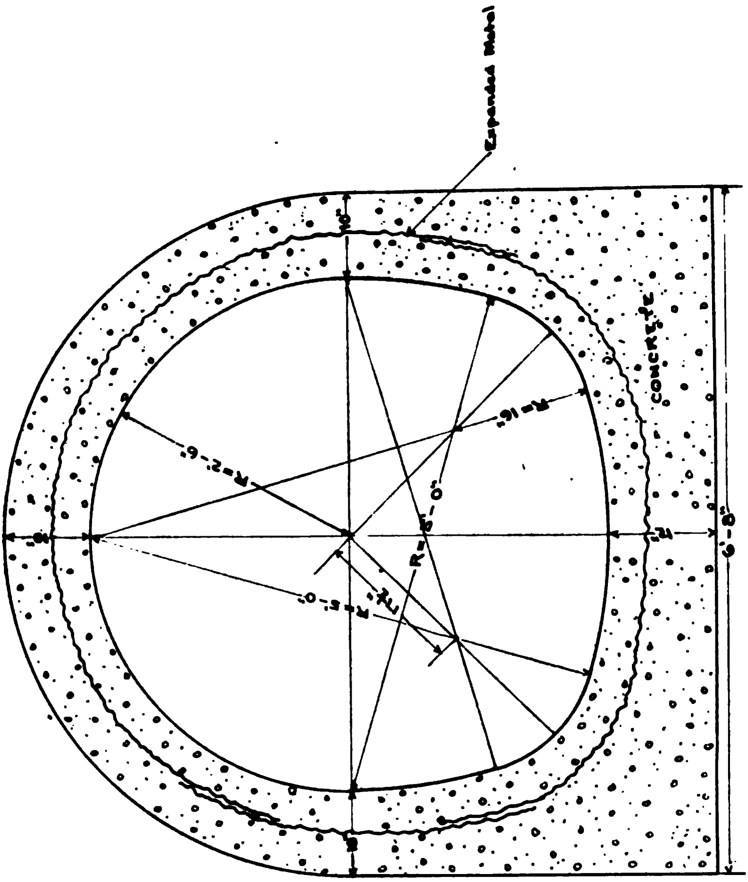
Not much concern was felt as to the strength of the concrete with the reservoir full and the conduits empty bringing the pressure on the outside, but to withstand an internal bursting pressure of 20 pounds per sq. in. which will bring a tensile stress of 80 pounds per sq. in. on the concrete, it was realized that the conduits must be constructed so as to develop the fullest possible strength of the concrete. For this it was essential that entire sections should be built as a monoliths, the concrete being put in continually around each section avoiding horizontal joints.

Some difficulty was experienced in getting proper forms, etc., to make this monolithic work successful, but after a little experimenting the conduits were built as easily by this method as they could have been by any other.

In the double conduits about 30 linear feet was a day's work for the force of men employed, and an expansion joint was made at the end of each day's work. This joint is clearly shown in one of the photographs submitted herewith. It has a depth of about six inches. The concrete has been laid principally in warm weather, and at the present time these joints show an opening of perhaps 1/32 of an inch. No serious leakage, however, a slight leakage at these joints will in no way impair their usefulness.

Last December some experimental sections of conduits were built, a section of single conduit and a section of double conduit. The double conduit was built practically as a monolith, but the construction of the single conduit was interrupted, and a horizontal joint was made in its section. Both of these sections were tested under hydraulic pressure, wooden heads being bolted to the ends so that the sections could be filled with water. The single conduit gave way at the horizontal joint under a pressure supposed to be about 15 pounds, the pressure being accidentally applied before the time set. The double conduit was tested up to 35 pounds, which was as much pressure as could be obtained with the heads used. The concrete



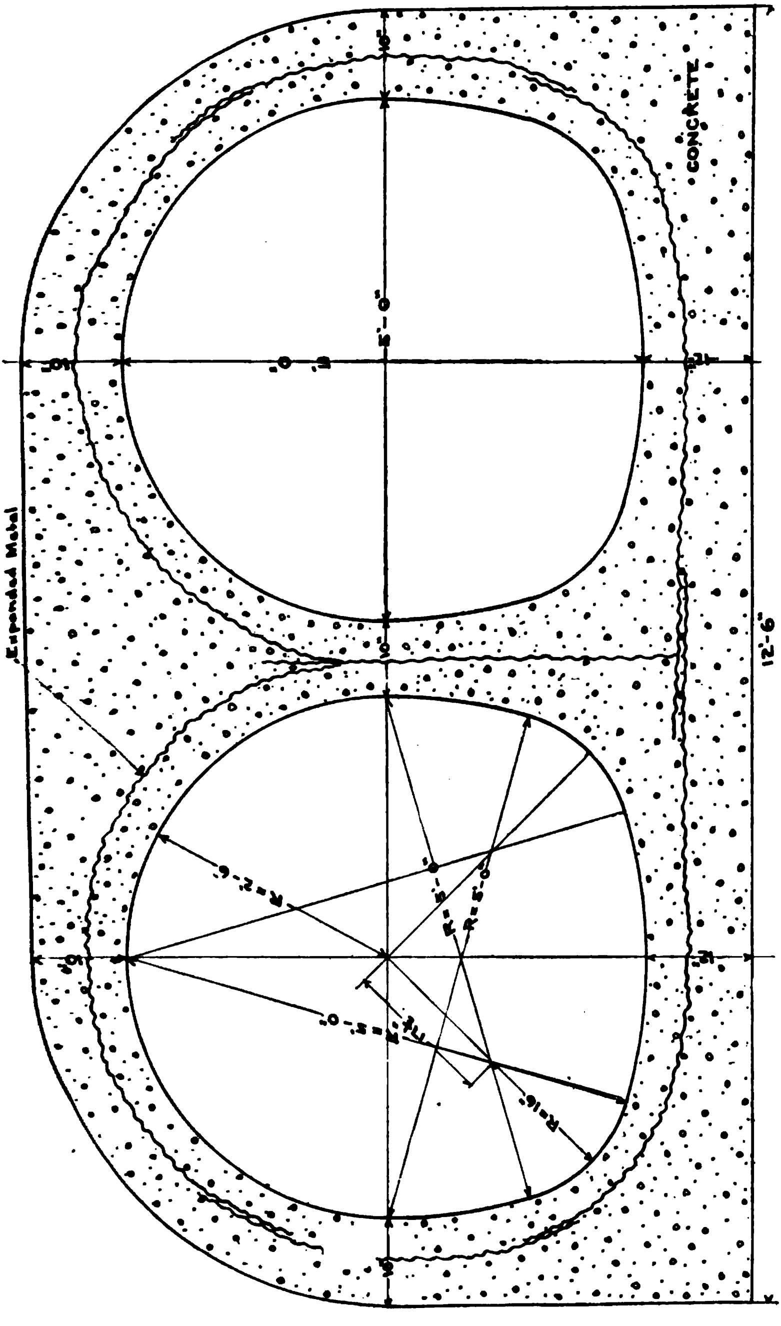


SECTION OF SINGLE CONDUIT

showed no signs whatever of weakness, and this section has been incorporated as part of the permanent work.

A comparison of the cost of these concrete conduits with cast iron pipe is interesting. 60 inch cast iron pipe could be obtained at the time contracts for this work were let, for $26.40 per ton of 2,240 pounds. The pipe would weigh about 1,000 pounds per foot and would cost to lay $2.20 per foot, making a total cost per foot outside of any excavation, of $14.00 for a single line, and $28.00 for a double line.

The double concrete conduit has 1½ cubic yards of concrete per foot and the single ¾ cubic yard of concrete per foot; the former also has 48 square feet of expanded metal per foot, and the latter 23 square feet of metal per foot. Contract prices for concrete and expanded metal were



SECTION OF DOUBLE CONDUIT

respectively, $6.20 per cubic yard and 5 cents per square foot. Thus giving cost of single conduit $5.95 per linear foot and cost of double conduit $11.75 per linear foot.

In making a comparison between cast iron and concrete, the cost of excavation was assumed the same in both cases, but as cast iron pipe 60 inches in diameter will float when empty, and as the concrete conduits will not, an additional charge per foot must be added to the cast iron pipe for cost of holding it down. For the single line in this particular case to load it would have meant a deeper trench at an added cost of about 60 cents per foot. For the double line it would have meant a fill over the pipes at an added cost of about $2.00 per foot.

For steel pipe, used in this work for the same purpose, the pipes themselves would have cost less, but the expense for loading would have been very much greater and it would have been necessary to provide some arrangement to strap down the pipe to prevent floating when empty. A comparison of the actual cost of steel pipe and concrete conduits has not been made, as the use of steel pipe in this manner in the bottom of the reservoir, was not considered advisable.

In round figures and at the present price of cast iron pipe the cost of a 5 foot single concrete conduit may be placed at $6.00 per foot, approximately one-half the cost of cast iron pipe. The total saving by the use of concrete conduits on this work was over $40,000.

MR. BALLARD: I have no desire to throw bouquets, and while I am speaking I should prefer to have the reader of the paper absent from the room. I will say, for the benefit of the gentlemen present, if any of you intend in the future building anything like a storage reservoir in your localities, no doubt a great deal of valuable information can be gained by visiting Newark and taking a look at the storage reservoir the author of the paper refers to. No doubt any gentleman who desires to avail himself of any benefit that might accrue to proposed work of that kind he may have in mind, if he will visit the City of Newark and see that piece of work built by Mr. Sherrerd, will, I am sure, see as good a piece of work as there is in the United States.

The session was then adjourned.

FIFTH SESSION.

The fifth session was called to order at 2:30 p. m., President Rust in the chair.

President Rust: The first paper of the afternoon session is the report of the Committee on Review, by Professor Talbott. Professor Talbot is not quite ready, but he suggests that the paper be sent to the Secretary, and it can be placed in the proceedings. Is this the desire of the convention? There being no objection we will consider it granted.

REPORT OF THE COMMITTEE ON REVIEW.

Instead of attempting to review the whole field of municipal activity, this report will briefly describe some of the larger and more notable pieces of municipal engineering work under construction during the past year.

One of the largest projects for the improvement of public water supply is that nearing completion in Philadelphia. The improvement includes an extension of the capacity of the waterworks system, a rearrangement of the distribution districts, and the construction of purification works to filter all the water which is taken from the Schuylkill and Delaware Rivers. The filtration works now completed or under contract will have a total capacity of 300,000,000 gallons per day, and the cost of the purification works and of the changes and extensions in the supply, carrying conduits and distribution system will be over twenty million dollars. The purification plants, which are of the slow-sand-filter type, will be the largest in the United States, if indeed they are not the largest in the world.

To show the magnitude of the new filtration works, the size of the largest plants may be cited. The Torresdale plant, taking water from the Delaware River, contains fifty-five filters, each having a net sand area of three-quarters of an acre, and has a total filtering capacity of 200,000,000 gallons per day. This area of 42 acres is roofed over with concrete and covered with earth. Adjacent to the filters is a clear water basin of 50,000,000 gallons capacity. An interesting point in the construction is that the concrete for the work was mixed at one point and the distribution over the seventy acres of territory was made by means of a system of tramways and cable ways. The capacity of the Torresdale plant when ten more filters of three-quarters acre each are added as planned and preliminary filtration of water is used will be 248,000,000 gallons per day. The Belmont plant, containing eighteen filters, has a capacity of 67,000,000 gallons per day; the Lower Roxbury plant with five filters, 12,000,000 gallons per day; and the Upper Roxbury plant with eight filters, 20,000,000 gallons per day. These three plants take water from the Schuylkill River. The Belmont works contain a sedimentation basin of 72,000,000 gallons capacity, a system of preliminary filters with a present capacity of 40,000,000 gallons per day, and a clear water basin of 16,500,000 gallons capacity. The Upper Roxbury works have no preliminary filters; the capacity of the clear-water basin is 8,000,000 gallons. Subsiding basins hold seven to ten days' supply. The Lower Roxbury works have a clear-water basin of 3,000,000 gallons capacity, and preliminary filters with a capacity of 12,000,000 gallons per day, together with 13,000,000 gallon subsiding basin. These preliminary filters are a feature of the plant and their use and effectiveness will be watched with interest. The preliminary filters consist of 5 inches of gravel, 10 inches of crushed furnace slag, 24 inches of finer furnace slag, and 9 inches of compressed sponge. The water passes upward through this bed, from the coarse to the fine, at a rate of 40,000,000 to 60,000,000 gallons per acre per day. It is expected that these preliminary filters will take from the Schuylkill and Delaware waters an amount of suspended matter which would require from three to four weeks to remove by storage in sedimentation basins, and that the rate through the sand filters may be raised from 3,000,000 gallons, the usual rate for slow-sand filters, to 6,000,000 gallons per acre per day.

Included in the improvements under way are new pumping stations, conduits, and many changes in the distribution system. One of the most important modifications is to limit the draft from the Schuylkill River to 100,000,000 gallons per day at the present time, as the minimum dry-weather flow of that stream is only about 150,000,000 gallons per day, and to re-arrange the system to permit the remainder of the city's needs to be supplied from the Delaware River at Torresdale. It is hoped that the daily consumption of water may by the final introduction of meters be reduced from 222 gallons per capita, the amount used in 1900, to 150 gallons per capita. The results of filtration obtained in the filters already put in service are very satisfactory. The improvement in quality of water is very marked. While the outlay seems enormous, the gain to the city will be proportionally large.

In marked contrast to the Philadelphia slow-sand filter in method of operation is the mechanical filter or rapid American filter of the East Jersey Water Company at Little Falls, New Jersey, which was put in operation a little more than a year ago. These filtration works have a nominal capacity of 32,000,000 gallons per day and are capable, for short periods, of yielding 48,000,000 gallons per day. The plant is therefore the largest mechanical filtration plant existing. It is also one of the first mechanical filters to employ concrete tanks on a large scale instead of wooden and steel tanks. The coagulating basin holds 1,750,000 gallons, between one and two hours' supply. Sixty-four filter tanks, each 24x15 feet, making 11,520 square feet. have a nominal filtration rate of 121,000,000 gallons per acre per day. The clear-water basins have a capacity of 3,500,000 gallons. The arrangement of filters and basins is very compact and the plant is a fine example of best practice in mechanical filters. The entire cost of the plant is said to have been about $15,000 per million gallons of nominal filtering capacity daily. The results of the filtration are stated to be very satisfactory.

A very good example of slow-sand filter is that now under construction by the Indianapolis Water Company. As this was visited by the Society. and as Mr. Davis has included a description of it in his paper on the Indianapolis waterworks, further reference is not necessary here, except to say that the water company hopes to be able to get higher rates of filtration than are given by the ordinary slow-sand filter.

A notable piece of engineering which would now be nearing completion but for the change in design which has attracted wide attention during the past year is the new Croton dam. This massive structure has been under construction for eleven years and is so nearly completed that the parapet wall is being put on for a portion of its length. The decision to substitute a masonry wall for a large part of the earthen dam already partly constructed at the south end has caused much discussion. The deeper excavation found necessary before a proper foundation for the masonry dam replacing the earthen dam could be had, and the difficulties attending the making of a joint between the old masonry and the new masonry. have increased the difficulties of construction greatly, and there will be considerable delay in completing the dam. Its present condition gives the observer a fair appreciation of the magnitude of the structure, and a visit will well repay the engineer interested in such work. The dam at the greatest depth is 260 feet from bottom of foundation to top of parapet wall, making the tallest dam in the world. The entire length is about 2.200 feet. It will impound 30,000,000,000 gallons of water.

Although the completion of the new Croton dam will add materially to the water resources of New York, the available supply will in a few years be insufficient, and active steps are being taken for additional sources of supply. The Commission on Additional Supply has reported recommending collecting areas north of the Croton water shed instead of taking water from the Hudson River as had been proposed. It is a noteworthy fact that, although these areas are subject to possible pollution but little.

more than the Croton area, the Commission has recommended that the proposed supply be filtered and has in mind the final filtration of the Croton supply. The selection and development of additional supply will form an interesting piece of engineering work. The Commission has been making a very elaborate and valuable survey of the distribution system of New York, determining the consumption by districts and discovering in many places unknown connections which used large quantities of water.

Another dam of considerable interest which is nearing completion is the Wachusett dam on the additional supply of Boston. While this dam is not so large as the new Croton dam, it is a noteworthy structure. It is 207 feet high above the rock bed at the deepest point, is 1,400 feet long, and will impound 63,000,000,000 gallons of water. This reservoir will be the second largest artificial reservoir in the world, being exceeded only by the Periyar in India, and its maximum height above the rock foundation will be exceeded only by the new Croton dam.

Another center of interest in construction for additional water supply is in New Jersey. The dam at Boonton has a total length of 3,115 feet, with a maximum height of 110 feet, and will rank as one of the twenty-four great dams in the world. The conduits from the reservoir to Jersey City have many features of interest.

The litigation over the discharge of the sewage of Chicago through the Sanitary District Canal and into the Illinois River has brought out matters of considerable interest to sanitary engineers, both in reference to the legal points involved in diverting water from one drainage basin to another and the liability and recourse for pollution of a water supply, and also for the investigations carried out and the opinions expressed by experts on the effect of dilution and the amount of purification effected in the flow to the Mississippi River. The evidence has not all been given, and the newspaper reports are fragmentary and probably not accurate. The publication of the data given by both Chicago and St. Louis of what has been the most elaborate and thorough investigation of sewage disposal by dilution ever made ought to constitute a valuable contribution to sanitary science. The construction of the intercepting sewers to divert sewage now discharging into Lake Michigan to the Sanitary District Canal has made some progress, but the work is far from completed.

So far as sewage purification is concerned, no works of magnitude have been under construction and no marked progress in methods can be recorded. Many small purification plants have been built, and many towns have such works under consideration.

Attention is called to phases of municipal activity somewhat unusual for American cities, the construction of the subways by the city of New York for purposes of rapid transit. This great undertaking has made rapid progress during the year, and it is expected that much of the system will be put in operation next year. The bridges over the East River, upon which good progress has been made during the year, are also municipal undertakings of some magnitude. In this connection the tunnel under the Hudson River for street railway service, upon which much work has been done. and the proposed Pennsylvania Railway tunnel under the Hudson and across Manhattan Island, upon which work is being started, although not municipal undertakings, are quite similar in purpose and may be counted among the notable engineering construction in progress during the year.

Time and opportuunity will not permit a further record of the important municipal undertakings of the year. Many of them are described in the committee reports and in the papers read at this meeting. A more detailed review might be of service, but for that the reader is referred to the engineering journals and the reports of municipal officers.

ARTHUR N. TALBOT, Chairman.

The next report will be from the Committee on Street Paving, Nelson P. Lewis, Chairman.

MR. LEWIS: The Committee on Street Paving has no report. I don't believe you want to hear a report from me or from the committee on this subject, but would rather hear the papers that have been prepared for submission at this meeting. I am going to get in a few remarks, however, even if I have no report to make for the committee.

The question of cost of pavements and the practice of laying pavements has been well considered by the Society at its various meetings and pretty well threshed out. The serious problem in the large cities at the present time is the correction of mistakes which have been made in the substitution of new pavements for old and antequated types. This is a really serious problem. The committee has decided to present a couple of cases of this nature to you. One is the prevalence of the cobble-stone, which prevails to such an undesirable extent in the cities of the Atlantic Coast. Another paper is on the cedar block pavement, which is a mistake made by many of the cities of the West. I will confess, however, I was surprised yesterday to see cedar block pavements in this city which I am assured have been in use ten years, and which surpass anything of the kind I have ever seen.

On the question of re-paving the record of Philadelphia has been an astounding one. You are aware of the many millions spent and the many miles of pavements laid there in the past few years. New York is now spending millions and millions for repaving. Millions also have been spent in new assessable improvements in the way of paving. I must acknowledge in this connection a debt I think we owe to the City of Indianapolis. You will remember that at some of our conventions held seven or eight years ago a member from Indianapolis presented a paper on the subject of rectangular wooden block pavements. I think the matter was not given at that time the consideration which it deserved. We had yesterday an opportunity to see a number of wooden block pavements. We experienced the pleasurable sensation of riding over them. They are good, smooth, and practically noiseless pavements. This type is now being laid to a much greater extent than ever before. I have in mind one city which has undertaken street improvements in a larger and more comprehensive way during the past year than ever before, Harrisburg, Pa., which has undertaken the laudable and difficult task of remaking itself. A movement was started by a party of gentlemen who organized themselves into a Municipal League, and they are about to do for Harrisburg what your Commercial Club has done for Indianapolis. They are repaving almost their entire city. They are taking up and applying a radical remedy to the defects of the drainage system. They are purifying their water supply, and are about to carry out an extensive system of park improvements. I know of no other instance where all of these departments of municipal housekeeping have been taken up in a serious way at the same time.

There is one other thing I wish to speak about. Some of you may have been aware of an apparently serious effort to discriminate against the use of macadam in the City of New York. The body which is obliged to authorize every improvement in the city has adopted a policy of refusing to approve any resolutions calling for the use of macadam unless the circumstances are very exceptional. The reason for this is two-fold. It is economic; it is also, I may say, moral. Under the charter of the City of New York no assessment can be made for re-paving. It can be laid if a majority of the owners of frontage sign a petition expressing their willingness to be assessed. It is, however, almost impossible to get such petitions. It seems unjust, then, that the property owners on one street should be alowed to lay a pavement at an original low cost, while neighbors on other streets are assessed for an expensive pavement. If a macadam pavement is maintained properly it must be sprinkled, and it is the most expensive of all pavements to maintain. The city at large, since it assumes responsibility for repairing and the burden of re-paving can scarcely be expected to encourage the laying of pavements of low first cost, where the expense of maintenance and repair begins the moment the pavement is complete. The cost of this amounts up materially immediately, whereas other modern pavements involve no expense at all for maintenance for several years.

I don't propose to detain you longer, but will say in addition to the list of papers printed on the program, I learned of one which has been prepared by Mr. Adam of Newark. Mr. Adam has expressed a desire to present the paper as early in the afternoon as possible, so I shall give way to him now.

TOPIC OF STREET PAVEMENTS IN THE CITY OF NEWARK AND OF PAVEMENTS GENERALLY.

BY ERNEST ADAM, ENGINEER DEPARTMENT OF STREETS AND HIGHWAYS.

Perhaps I will be pardoned for digressing from the subject proper, in giving an introductory statement relating to the history of this city.

It was in May, 1666, that about thirty families migrated from Milford, Conn., and located on the once beautiful bank of the Passayak (now Passaic) River. The original territory was purchased from the Indians and contained about seventy square miles; the consideration for this purchase was one hundred and thirty pounds New England currency ($325), twelve Indian blankets, and twelve Indian guns. The city comprises now but twenty-two square miles, sixteen of upland and six of meadow or low land. Newark was incorporated as a city in the year 1836.

According to the U. S. census of 1900, it then contained a population of 240,070, and was the sixteenth in the rank of 120 cities containing a population of 30,000 or over; the estimated population of Newark, at the present time, is 265,000.

The assessed valuation of property in 1902 was:

Real estate	$131,243,762
Personal	33,247,650
	$164,491,412
Less personal debts	1,188,408
Net	$163,303,004

The amount of taxes collected was:

County tax	$ 969,695
City expenses	2,221,994
Sinking fund and interest	496,128
Total	$ 3,687,815
The city's indebtedness was	19,049,000
Amount in sinking fund	5,550,200
Net	$ 13,498,800

Of the gross indebtedness, $9,847,000 is represented by water bonds, for which the sinking fund and interest is provided from the receipts of the water department.

The first pavement in the city was laid in 1853, and consisted of cobble-stones; this event was almost brought about by coercion. In the previous year Kossuth, the great Hungarian patriot, was asked to visit Newark, on which occasion a few citizens of the progressive element hired several men to stand in a scow, which was drawn by a tandem of horses through the mud in the principal street, now the pride of the city, it being 132 feet wide.

The use of cobble-stones was almost exclusively continued until the year 1872, when other pavements consisting of granite and trap-rock blocks laid on a sand foundation, and telford were introduced. The maximum price paid for granite pavement in that year was $3.95 per square yard; for telford, 16 inches deep, $2.75.

In the year 1869 the American Nicholson Paving Co. laid 8,217 square yards of wood block pavement in a section of our main thoroughfares, at $4.50 per square yard, it being replaced in 1879 with oblong granite blocks on sand; but the wood pavement, long before it was removed, was in a poor condition. In 1872 it was attempted to have the same kind of pavement laid in another section of the same street, to the amount of 27,000 square yards, but the then acting mayor, after a severe struggle, vetoed the proceedings. One of the neighboring cities had its financial standing quite severely affected, on account of having laid so much of this wood pavement during the boom period, prior to the panic of 1873.

About the year 1888 two short streets, containing 3,700 square yards, were paved with asphalt blocks on a sand foundation; the blocks then used were 12 inches long, 4 inches wide and 5 inches deep. The price paid for the pavement in one of the streets was $2.54 per square yard. One of the streets was repaved with granite blocks in 1893, and the other with sheet asphalt. in 1894; but both old pavements were in a poor condition along the center of the roadway, before the others were substituted. There was none laid since, until last year, when blocks only 2 inches deep were used in paving the tracks, in a street which was paved with sheet asphalt outside of the tracks. There are a number of them cracked, but principally caused by the steam roller which was used in laying the sheet asphalt. The blocks were bedded in Portland cement mortar, which was laid over the concrete foundation.

It was not until 1892 that the first granite block pavement was laid on concrete with gravel and paving mastic in the joints, or what is commonly called improved granite block pavement: the sum paid was $3.29 per square yard.

The first sheet asphalt pavement was laid in 1889, the specifications calling for Trinidad Lake asphalt, two streets being paved with this material in that year, one at $2.93 and the other at $2.80 per square yard; under a guarantee of five years. The one is still in a fair condition, while the other has required numerous and quite extensive repairs.

The greater part of the asphalt pavements laid, consist of Trinidad Lake asphalt; some of Trinidad Land asphalt, which is in as fair condition as the other. A few streets were paved with the use of Bermudez Lake asphalt, and a limited number with asphalt obtained in Santa Barbara Co., Cal.

In one street which was surfaced with Trinidad Land asphalt, the temperature of the weather was so low that the concrete was frosted to a depth of four inches, and twice the snow had to be shoveled off the binder, before the wearing surface could be laid, and yet the pavement is in a good condition after five years of service.

At first the wearing surface was laid on a cushion coat ½ inch thick, until 1893, when a binder course 1½ inches thick was substituted for it. Of course this city, like a good many others, experienced the shoving or rolling effect upon a mere cushion coat, although some on a binder course have that tendency also, but in a less degree.

One street containing 3,500 square yards has been entirely re-surfaced on account of the bad rolls, seven years after the original surface was laid. As the guarantee for five years had expired, the city had to pay for the re-surfacing, which cost at the rate of $1.53 per square yard, including the binder course.

It was presumed by some persons that the expansion of the concrete had a tendency of causing cracks in the asphalt covering, I therefore made a provision in our specifications, permitting the contractor to provide for expansion joints in the concrete at intervals of 300 feet, which were to be filled with a flexible paving mixture; but none of the contractors so far have availed themselves of this privilege.

There was only a five-year guarantee required for the maintenance of the asphalt pavements until the year 1898; from then on it was made ten years. In order to avoid the possibility on part of the property owners along the line of the pavement, to contend in court that they were burdened with an undue repair account, the contract provided for the payment of the sum of 25 cents in addition to the price bid per square yard for the maintenance of the pavement during the second period of five years, to be paid in five yearly installments, providing the pavement was in good condition. This remained in force until the year 1900, when the additional allowance was reduced to 12½ cents, owing to statements found in reports of other cities, which showed that the pavement could be maintained for that amount and period, when properly laid.

For the past three years the board employed a chemist to make analyses of the materials contained in the asphalt mixture; although small shortcomings were not persecuted, yet this precaution has given satisfactory results.

I was informed that in the City of New York only a five-year guarantee is now required, instead of ten or fifteen years, as formerly. I can only attribute this change to the facility which that city has, through their salaried and experienced chemist, in determining the proper requisites of an asphalt mixture in order to procure a good pavement. Other cities which have not this facility, and they are numerous, will, in my opinion, still look for security in an extended period of guarantee.

Although the first cost per square yard for asphalt pavement laid in this city in 1902 was quite low in comparison with that paid in other cities, averaging but $1.89 in streets without car tracks, yet the board has practically closed down on asphalt pavings this year, on account in anticipation of the large amount of money which will have to be paid the companies for the maintenance under the contracts for a ten-year guarantee.

It has been the custom of the board within the past three years to include more than one kind of pavement in the legal proceedings, and when the proposals for the work were received, to decide which pavement to select. There is no doubt that this method, in most cases, had a tendency of procuring moderate prices.

The first brick pavements were laid in 1895, and moderately continued until within the past two years, when the quantity increased more rapidly. There are pavements laid with fire-clay and shale brick and block from different manufacturers, and laid with paving mastic, cement grout, and sand filler in the joints. Cement grout filler was used in the first pavements laid, without providing for expansion joints, and the result was the unavoidable rumbling noise. The last street paved in which a cement grout was used, measuring 60 feet between curbs with a double track in the center, the specifications required five transverse joints, three-eights inch wide at intervals of 25 feet, and one-half inch wide along the curb to be filled with paving mastic. There was no complaint made of any objectionable noise, but of the tar which was forced out of the joints and accumulated in the gutters.

Lately only sand was used as a filler; this prevents any possible noise, but exposes the edges of the brick to greater wear.

I might almost say that the city presents a fair opportunity of object teaching in brick paving, on account of the variety of methods and materials applied therein.

The board has recently awarded three contracts to Warren Bros. for laying their bitulithic pavement, amounting to 31,000 square yards, with an additional 8,000 square yards which is to be paid in the space occupied by a double track street railway and one foot outside, in one of the streets under contract. The pavement is to be 8 inches thick, consisting of 6-inch foundation and 2-inch bituminous mixture or wearing surface, when thoroughly rolled. The price is $2.25 per square vard in each instance and under a guarantee of ten years, the surety bond to be for 25 per cent. of the amount of the contract. In addition to this bond, there are 5 per cent. retained of the amount of the estimate for five years, 2 per cent. to be refunded at the end of the third year and 3 per cent. at the end of the fifth year, providing the pavement is in good condition at the respective periods; the contract form for all other pavements contain the same conditions. There is no extra allowance in addition to the price bid per square yard, as is the case for asphalt pavements.

The company was reluctant in giving a ten-year guarantee, but it was deemed advisable to require this period on account of the infancy of this kind of pavement.

The guarantee clause in the contract also provides that the proposal for laying the pavement shall be accompanied with an affidavit, duly verified, "that the amount bid has not been in any degree increased by reason of the guarantee required, and that it does not include any estimate whatever of the cost of repairing said pavement, if the same shall become necessary during the guarantee period."

In preparing the specifications, I inserted the clause relating to the requirements of the bitumen found in a copy of New York specifications, as I considered it preferable to the one contained in another copy; having no doubt of its being compiled by the experienced chemist in the employ of the City of New York. It reads as follows:

"All grades of the bituminous cement shall be free from water, petroleum, oil, water, gas or process tars, natural asphalt, soluble salts, and shall be specially refined at low temperatures, preventing undue oxidation or injurious molecular disruption; and the process shall, as much as possible, remove all the light oils, naphthaline and other crystaline matter, which are easily susceptible to atmospheric influences. The bituminous cement shall be uneffected by water; it shall contain a sufficient quantity of free carbon filler to give the best results, and after determining a standard of purity, shall contain a uniform quantity of carbon throughout the entire work."

I have also inserted the following:

"The engineer or his deputies shall at all times have free access to the plant and materials belonging to the contractor, and have the right to take a sample of the various materials for the purpose of making examinations, tests and chemical analyses."

"The depth of the pavement will be constantly tested by gauges furnished by the engineer; but after its completion and before the payment of the final estate, the general superintendent of works may direct to have the same tested as to depth or for other purposes, at various points along the entire length of the pavement; the contractor is to make the required cuttings and thereafter restore the pavement to its original condition, without any compensation." Being the same clauses as contained in the specifications for asphalt pavement.

This kind of pavement being patented, it was necessary that a petition in writing was presented to the board, signed by the owners of a majority of the feet of land fronting on the respective street; in accordance with a provision of the municipal laws.

It was in the year 1889 that one of the local papers had published an article relating to tar macadam pavements in the City of Hamilton, Ont., particularly laying stress upon the moderate cost. In going to the convention of this Society held in Toronto in the same year, the members of the board at that time, stopped over on their way to Toronto and made a personal examination of those pavements. They were quite enthusiastic about them, and thought they had found a good and cheap pavement, forming the mean between telford and stone block pavements, both as to cost and conditions, avoiding the heavy repair account and dust nuisance of the first and the larger price and roughness of surface of the other. The cost in Hamilton at the time was 80 to 85 cents per square yard, consisting of a 10-inch pavement, 6 inches of 2 to 3-inch stone for foundation and 4 inches of 1½-inch stone and screenings mixed with coal-tar, for the top covering or wearing surface. We were shown a residential street in which the pavement was said to have been laid eleven years previous, the surface being still hard but uneven.

In the succeeding year, or in 1900, the board authorized me to go to Toronto to observe the laying of tar macadam in one of the streets. That pavement was only 8 inches deep, 4 inches foundation and 4 inches of tar mixture: the cost was about $1.35 per square yard.

I wanted to make myself familiar with the manner of laying such pavements, as the board intended to lay it in Newark on an avenue containing about 24,000 square yards, as a top covering over a telford pavement which was in need of extensive repairs. It was the intention of re-surfacing only two blocks at first. I had made all the necessary preparations, when the idea was abandoned. I had estimated the cost to be 75 cents per square yard for a depth of 4 inches tar macadam covering, when rolled.

The person who was to furnish the tar and kettles, laid a small area of tar macadam in the driveway to his factory yard, and it is in perfect condition this day; he informed me that it was only 4 inches thick and used only 1½-inch stone.

I concede that the method adopted by the Warren Bros. in preparing the mixture for the top covering, aside from the superior quality of their bitumen, is scientific and better than the one that had been pursued in laying the ordinary macadam.

One of the principal, if not the principal, question is how long will the cohesive qualities of the bitumen last. It is my view that when the end of that period has arrived, the top covering will to a certain degree disintegrate, in a similar manner as an asphalt wearing surface, on account of containing mineral particles graded down from a size of 1½ inches to mere sand.

It was my opinion that the price of bitulithic pavement was rather high, in comparison with that paid in our vicinity for a telford or macadam pavement. In 1901 the city contracted for laying 40,000 square yards of telford pavement, at 97 cents per square yard, under a guarantee of maintenance for five years. The pavement is of trap-rock throughout and 10 inches deep; having a regularly laid foundation of 6-inch stone; an intermediate course of 2-inch stone, 2 inches deep, and a top layer of 1½-inch stone, also 2 inches deep; with a thin cover of screenings.

At the same time of letting the contract for bitulithic pavement, there was a contract awarded to the U. S. Wood Preserving Co. of New York for paving a street with its creo-resinate wood blocks; the price is $3.76 per square yard and quantity 1,300 square yards. In the City of Brooklyn the price was $3.19 for the same kind of pavement and laid in the same manner, with the exception that our specifications requires a mastic filler in the joints for a width of 4 feet on each side of the curb, instead of all sand as in Brooklyn. I have also adopted the method pursued in that city of laying and bedding the blocks in Portland cement mortar on top of the concrete, instead on a sand cushion; for the reason that if any moisture should work its way under the blocks where it had a chance to do more mischieve. I experienced this with a granite block pavement, where I was not permitted by a former board to use an impervious filler in the joints. Of course there was no chance of deteriorating this material by moisture, but of lifting the blocks by action of the frost, and making the surface somewhat uneven. There were a few other elements connected with the contract awarded for the wood block pavement, but, in my opinion, of not such material consequences as to warrant the difference between the two prices. The matter was submitted to the property owners, who decided to have the board award the contract at the price bid.

The guarantee for maintenance and amount of bond are the same as for bitulithic pavement.

Total number of miles and square yards of street pavement in the City of Newark (including the work contracted for but unfinished, and excepting pavement in the street railway tracks):

	Miles.	Sq. Yds.
Asphalt	51.10	1,035,498
Granite block	47.34	923,597
Brick	10.58	220,730
Trap-rock brick	12.29	210,090
Telford	13.11	177,202
Cobble or boulder	10.44	176,292
Bitulithic	1.48	30,780
Wood block	0.08	1,300
Total	146.42	2,775,489

The cost of all pavements up to date (including those unfinished) is $7,052,110; excepting pavements done under private contracts, amount paid to inspectors, legal expenses and other charges.

The average amount paid to inspectors during a previous period of five years was 1 8-10 per cent. of the cost of the pavement, or 3 2-3 cents per square yard.

The average price per square yard paid and to be paid within the last three years, including the present one, is as follows:

YEAR	ASPHALT	BRICK				GRANITE	
	6 in. con. base, 1½ in. binder and 2 in. wearing surface	6 in. con. base and 1½ in. sand cushion				6 in. con. base, 2 in. sand cush. gravel and tar filler	4 in. sand foundation only
		Cement Grout Filler		Sand Filler			
		Shale	Fire-Clay	Shale	Fire-Clay		
1901	$1.85⅓	....	$2.29	.....	.....	$2.68	$1.78
1902	1.90⅔	....	2.04	.....	$1.94⅔	2.78	1.96⅔
1903	1.97	$2.12	....	$1.92½	. 2.16	3.15	2.23⅓
			MAXIMUM	Cost per	Sq. Yd.		
1901	2.11	....	2.33	.....	.....	2.73	1.98
1902	2.09	....	2.04	2.10	2.05	2.79	1.98
1903	1.97	2.15	....	2.09	2.33	3.15	2 45
			MINIMUM	Cost per	Sq. Yd.		
1901	1.75	....	2.25	.....	.....	1.98	1.68
1902	1.89	....	2.04	2.10	1.85	2.74	1.88
1903	1.97	2.09	....	1.83	2.03	3.15	2.18

The concrete in all cases consists of a matrix containing one part of common cement, two parts of sand and five parts of stone; and the necessary excavation is included in the cost of the pavement.

The average amount assessed upon the property owners abutting the improvement, was seventy-eight per cent. of the total cost, during a period of four years.

In 1895 an act was passed by the Legislature, giving the opportunity of paying a paving assessment in five yearly installments, with a charge of 5 per cent. interest.

A statement presented in 1899 by the city auditor shows that in the first year after the act was confirmed, 46 per cent. of the cost assessed on the property owners was paid; 22 per cent. in the second; 11 per cent. in the third; 10 per cent. in the fourth, and 11 per cent. remained unpaid, the fifth year not being covered.

Not many persons, excepting the officials connected with the respective departments, realize how much money is invested in street improvements, until they see the aggregate cost. It is only a deplorable condition, as might be said, that pavements suffer so much by constant disturbances of one kind or another. No matter how carefully the repairs are made, but it is more often the contrary, the original condition can never be restored. We can only hope for a better turn in the future.

The Secretary read the following letter from J W. Howard:

Oct. 21, 1903.

C. H. Rust, President American Society of Municipal Improvements,
Assembly Room, Commercial Club Bldg.,
Meridian St., Indianapolis. Ind.,

Dear Sir:—

I very much regret that I am suddenly detained and for the first time cannot attend and profit by the convention of the Society which does so much to improve the condition of cities.

I beg to suggest that the members discuss the question of SOLUBILITY OF SOME ASPHALTUMS IN WATER AND OF OTHER MATERIALS OF CONSTRUCTION OF ASPHALT PAVEMENTS; because water certainly is the principal factor, directly or indirectly, of injury to asphalt pavements. Water not only attacks poor asphaltum and other inferior ingredients, but also augments the wear from traffic. If the pavement is not dense, water, penetrating the pavement, does damage by freezing and expansion. The maintaining of many thousand miles of asphalt pavements now laid in several hundred cities of the world, is a source of great expense. Some cities have reduced this expense by requiring better asphalt pavements and ones more economical to maintain.

Inasmuch as water is the principal factor in the destruction of asphalt pavements as laid in most American cities, we should give close attention to this matter. While other pavements are also expensive to maintain in constant good order, I would confine this discussion to asphalt pavements.

A refined asphaltum, containing a low per cent. of bitumen, is more quickly attacked by water, as a rule, than one containing a high per cent. It dissolves certain salts and other materials not bitumen.

Has the time not arrived when cities can demand a refined asphaltum and asphaltic-cement containing at least 90 or 95% of pure bitumen? Are there not now sufficient available supplies of high per cent. and high grade asphaltums to warrant thus raising the standard of purity in the specifications of cities? I think so. Both the large combinations and groups of small asphalt companies can supply such high grades if insisted upon by cities and at prices as cheap as asphaltums containing a lower per cent. In fact the many competing asphaltums of high grades above 90% pure will lay at least 90 square yards per ton of asphaltum, and those containing only 50 to 60% will lay about 60 yards of asphalt pavement per ton.

The time seems ripe to raise the quality of asphalt pavements in Amercian cities. The cities now have asphalt pavements at low first cost. If the quality is improved, the cost of maintenance will be reduced. It is economic maintenance which cities desire in connection with asphalt pavements.

You can have the Secretary read this to the Convention as a brief contribution which I venture to make as the result of special observation in various cities I have served, especially since the last Convention.

Sincerely yours,

JAMES W. HOWARD,
Consulting Engineer.

PRESIDENT RUST: I think it would be well to have all the papers on pavements read, and they can all be dicussed together.

THE GUARANTEE AND MAINTENANCE OF ASPHALT PAVEMENTS IN ROCHESTER, N. Y.

BY WM. J. STEWART, FIRST ASSISTANT CITY ENGINEER, ROCHESTER, N. Y.

Asphalt pavements in the United States date from 1876, Washington being the first to lay them. Their popularity began to spread over the country from this time, until we have now over 30,000,000 square yards in over 130 cities. Rock asphalt was first used in Paris in 1854, and was laid on the principal streets and avenues. Many miles of splendid pavements have been laid in each of these cities, but like probably all other cities that have laid asphalt, some poor ones have also been laid. This has led to a great deal of criticism of asphalt, and has made the question of gurantee and maintenance a much debated one. Different cities, as well as engineering societies, have discussed for some time what should be the proper length of guarantee, as well as what should be a reasonable annual cost to cities for maintenance after the expiration of said guarantee.

The cost of maintenance in other cities has been greater than the experience of Rochester has shown to be necessary there. Thus, Washington has paid for repairs 3 cents per square yard for the first five-year period and 8 cents for the second five-year period, for the wearing surface. Buffalo, 6 cents for the first, and 5 cents for the second period. Cincinnati, 7½ cents for the first, and 4 cents for the second. Omaha has a contract for ten years at 8 cents per square yard per annum, and Denver at 10 cents. New York and Washington pay for repairs to the wearing surface by the cubic foot measured in the carts on the street, the price last year in New York being 90 cents per cubic foot. One advantage of this plan over all the others is where the wearing surface is reduced in thickness from traffic only the amount of asphalt necessary to repair the hole is paid for, instead of the standard thickness fixed in the contract.

The European plan seems to be to pay a fixed amount per square yard per annum on the whole area of the pavement, and not on the area actually repaired. The periods of guarantee vary from five to fifteen years, five years being more often used.

Asphalt pavements in Rochester date from 1885, the length of guarantee on some streets being five years, and ten years on others. The character or location of the street had nothing to do with the length of guarantee. Since 1897 ten years has been the length of all guarantees. In 1901 the Common Council passed a general ordinance which provided for a uniform guarantee of ten years on all kinds of pavements. For asphalt pavements the ordinance provides as follows:

"The asphalt surface in sheet asphalt pavements shall be composed of one of the standard mixtures laid in this city for the past five years, or any other asphalt mixture that has been laid in quantities of at least 3,000 square yards, and has worn well for a period of not less than three years. It shall be laid upon a concrete foundation. Asphalt block pavement shall be constructed of asphalt block made of crushed trap rock stone or other hard, durable stone mixed in the asphalt, and laid upon a concrete foundation."

"These pavements shall be laid under a guarantee of at least ten years' duration, said guarantee to be protected by a cash reserve of at least 10 per cent. of the amount of the final estimate for the asphalt pavement, and in addition thereto, of a good and sufficient bond to the amount of not less than 40 per cent. of the estimated cost of the asphalt pavement."

Our pavements have been laid by four different companies, the Warren-Scharf Asphalt Paving Company laying the Trinidad Lake, the Rock Asphalt Pavement Company, the German and Sicilian natural rock, the Rochester Vulcanite Pavement Company, the vulcanite, and the firm of Whitmore, Rauber & Vicinus, the Trinidad. Since 1892 the Vulcanite Pavement Company has laid only Trinidad Lake.

The first pavement laid was on a fine residence street with considerable traffic, having a roadway 38 feet wide and an area of 10,240 square yards. After a service of eighteen years this pavement is in good condition. The average cost per square yard for the years it has been maintained by the city has been 2.2 cents. It was guaranteed for five years, but nothing was spent on it until the eleventh year. The street had very little grade, and $1,287 was spent in 1897 for repairs to the gutters, which were badly rotted by water standing therein. This pavement was Trinidad Lake asphalt.

The first rock asphalt was laid in 1886. The repairs required on the rock asphalt pavement have been very small, and they were maintained by the company at its own expense until 1898.

The appended table from our Annual Report for 1902, showing the cost of repairs to asphalt pavements paid by the city, gives some very interesting figures in the maintenance of asphalt pavements at a minimum cost. It includes none of the pavement in the tracks of the Rochester Railway Company, nor for two feet outside of the tracks, as that is charged to said company. The cost will be found generally quite low, with a few exceptions. West Avenue shows an average cost per square yard, for the years maintained, of 7 cents. This is one of the main streets of the city, and the pavement one of the first built. A double line of tracks originally poorly laid. This pavement was about a mile in length, 1,300 feet of which carrying a very heavy traffic, was continually in need of repairs, and no matter how often the holes were repaired, it was but a shore time before it was in need of as much more. This year this portion was taken up and a Medina block stone pavement laid in its place. In making the excavations for the new pavement all underground constructions, such as water and gas pipes, sewers, electric subways, etc., were examined, and the gas pipes which lay on both sides of the street were found to leak badly. The ground was completely impregnated with gas in many places. This softened the asphalt and was probably the cause of the trouble with the pavement.

Another street which shows a rather high rate is Spring Street, at 9½ cents. This is also a business street with heavy traffic.

Division Street, showing a cost of 17 cents, is only a small amount of 300 yards over an area-way, and was almost entirely replaced.

Chili Avenue, at 5 cents, is another street of which there is no doubt of the poor quality of the asphalt. Though this is in the suburbs, it has a comparatively heavy traffic. All the rest of our streets have cost much less than these, many less than 1 cent.

The average cost for maintenance per year has been as follows:

1897, when the first contract for general repairs was let	4.21 cents
1898	2.20 cents
1899	2.34 cents
1900	2.11 cents
1901	3.17 cents
1902	4.72 cents

The total amount of asphalt pavement in the city is as follows:

Trinidad Lake	23.972 miles
Trinidad Land	4.404 miles
Rock	11.355 miles
Vulcanite	6.805 miles
Total	46.536 miles, or 762,731.3 sq. yds.

Total number of sq.yds. on which the guarantees have expired	450,907
Total number of sq. yds. still under guarantee	311,824

The following table shows the average cost per square yard, and the length of guarantee, for each year since asphalt has been laid in Rochester:

Year.	Guarantee.	Cost per sq. yd.
1885	5 years	$2.50
1886	5 years	2.73
1886	10 years	2.65
1887	5 years	2.75
1888	5 years	2.75
1889	5 years	2.78
1889	10 years	2.75
1890	5 years	2.75
1890	10 years	2.75
1891	5 years	2.70
1892	5 years	2.55
1893	5 years	2.65
1893	10 years	2.60
1894	5 years	2.60
1894	10 years	2.65
1895	5 years	2.51
1896	5 years	2.19
1897	5 years	2.43
1897	10 years	2.45
1898	10 years	2.26
*1898	15 years	2.60
1899	10 years	2.04
1900	10 years	2.26
1901	10 years	2.02
1902	10 years	1.74

All asphalt pavements are now laid on a 6-inch concrete foundation, with one inch of binder and two inches of wearing surface.

The demand for brick pavements has brought down the price for asphalt lately, our bids being about the same for each.

It will be seen that local conditions have fixed prices, rather than the length of the guarantee period, and our experience leads us to believe that with a well-built pavement on a street of ordinary traffic without tracks, very little repairing will be required in ten years. There is no way of knowing whether the cement or sand has been overheated before mixing

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*The only 15-year guarantee.

at the works, or whether the proper proportions of cement, sand and stone dust have been used in every mixture. If an expert inspector is on the street he may prevent a poor binder with too much tar in it from being laid on a concrete foundation that is too green, or with his thermometer see that the asphalt is not too cold, and also that the compression is right at all points. Contractors, though having complete control of the material and the manipulation of it, still sometimes build a bad pavement, so that it does not seem unreasonable to demand a guarantee of this length.

In this connection the following quotation from a discussion before the American Society of Civil Engineers, on the subject "The Maintenance of Asphalt Pavements," by Mr. Nelson P. Lewis, Chairman of our Committee on Street Paving, is very interesting at this time:

"But conditions are changing in a large city like New York, and they are changing for the better, and account should be taken of the changes. Steel tires are wider than they were, a large proportion of them has been replaced by those of rubber horseshoes are lighter, and one will not discount the future properly if he does not take into account the large percentage of horseless, smooth-wheeled vehicles which will be found on our streets before a ten or a fifteen-year contract made at the present time will have expired. All these changes will tend to simplify the problem of maintaining our asphalt pavements. The elements most injurious to them are constantly being eliminated."

The method adopted in Rochester for making the repairs is as follows:

Each year bids are received for re-surfacing, including the concrete foundation, also for resurfacing only, by the square yard. Skimming was practiced in the years 1897, 1898 and 1899, and then discontinued as not being satisfactory. The price bid the first year that skimming was tried was $1.60 per square yard, the second year $1.40 and the third and last year $1.25. The price paid in 1902 for re-surfacing with Trinidad was $1.65, and including the concrete, $2.38. For re-surfacing with rock, $1.65, and including the concrete, $2.50. The price this year for re-surfacing with Trinidad was $1.28; including the concrete, $1.88. For resurfacing with rock, $1.44; including the concrete, $2.29.

One man from the city engineer's office has supervision over all the repairs, and directs an inspector who goes over a street with the contractor marking such places as must be repaired. The contractor is not allowed to cut out any more than is determined necessary by the inspector. After the streets is repaired the patches are measured and located by our representative, and the contractor proceeds to the next street to be repaired. The general repairs are made in the spring, and some in the fall.

THE PASSING OF THE COBBLE STONE.

BY GEO. W. TILLSON, CHIEF ENGINEER, BUREAU OF HIGHWAYS, BROOKLYN, N. Y.

The first pavement laid in this country was in Boston about 1650, and in New York in 1656, the material in both cases being cobblestone, and this material has been used more or less as a paving material for the streets of this country ever since, so much so indeed that at one time Philadelphia had 512 miles of cobblestone pavement, Balitmore 320 and Brooklyn 308 miles.

At the present time Philadelphia has but 42 miles, Brooklyn 172 miles, and Baltimore 320 miles, or as much as it ever had.

It is the province of this paper to treat of the decrease of the cobblestone pavement in the present Borough of Brooklyn City of New York, I quote herewith from the specifications for cobblsetone pavements in that borough, taken from one of the last contracts made:

"Quality"	"Sec. 6. STONE—The stones are to be of the best selected water or bank paving stones, of a durable and uniform quality.
"Size of stones."	"No stone shall be less than four (4) inches, nor more than eight (8) inches, in any direction on the surface, and not less than six (6) nor more than ten (10) inches in depth, and in case any stones are furnished which do not comply with specification, they will be rejected.
"Manner of laying."	No triangular or split stone will be allowed; all stones shall be set perpendicular and on their small ends; the large stones to be placed on the sides of the street, and the small ones in the center or crown, with a proper graduation of sizes between."

Probably all of the cobblestone pavements in Brooklyn were laid under similar specifications. When the pavements first began to be laid, it was a comparatively easy matter to obtain stones that approximately conformed to these requirements, but as they came into general use the stock of good stones was used up, and then stones of practically all sizes and shapes were used instead of true specification stones. It was a common occurrence to find in the City of Brooklyn in the alleged cobblestone pavements stones that would be from 15 to 18 inches long and from 10 to 12 inches wide and rough and irregular on the top. The writer in one case measured a stone in one street that was three feet long and eleven inches wide. At another time when a certain street was being repaved with granite blocks, a bowlder was discovered among the cobblestones, so large that it had to be blasted before it could be removed. This was evidently on the street when it was originally graded, and simply lowered down to conform to the grade of the new pavement.

I show you herewith a diagram which represents graphically the different kinds of pavements in Brooklyn from 1880 up to the present time. You will see that the greatest amounts of cobblestone pavement was on the 1st of January, 1888, that it decreased regularly until 1901, when it remained stationary until 1893, and then increased a little until 1895, when its decrease has been constant.

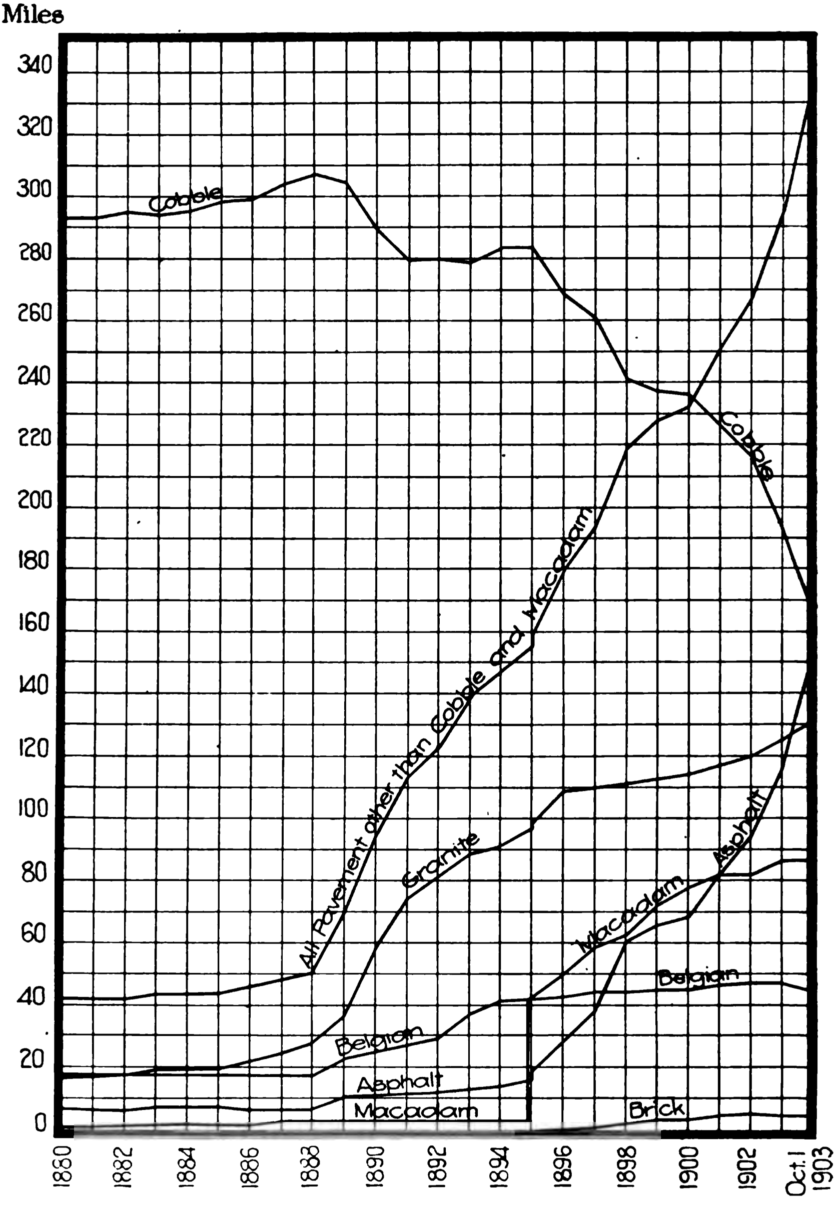
The diagram shows very plainly that in 1888 cobblestone was practically the only paving material in Brooklyn. At that time there were less than 25 miles of granite, only about 8 miles of asphalt, and only 50 miles of all pavements other than cobble. The diagram shows very plainly how rapidly these other pavements have increased. It will also show, although perhaps not pertinent to this paper, the rapid increase of the asphalt pavements. On the first of January, 1903, asphalt and cobble were 73 miles apart. On the first of October, 1903, they were only 25 miles apart, and if the weather be favorable the remainder of the season, I have no doubt that the mileage of asphalt pavements in Brooklyn on the first of January, 1904, will exceed that of .cobblestone.

In this paper I have considered the pavements down to the first of October this year, as the changes going on in the Borough of Brooklyn are such that a statement made of the condition of pavements on the first of July will not hold good for the first of October. That can be appreciated when it is understood that during the quarter ending October 1st, 1903, 28 miles of new pavements were laid in Brooklyn, and when the present contracts now in force are carried out, the mileage of cobblestone will be reduced to 132 miles.

Another feature in this connection, which is very gratifying to the Borough officials of Brooklyn, is that the cobblestone is being absolutely destroyed and disappearing from the face of the earth. In former years, when the cobblestones were taken up from streets where new pavements were to be laid, a great part of them were used in patching up old cobble pavements, and it was quite a problem to dispose of the remainder. Now, however, they are all being broken up and used in the concrete which is being laid for the foundation of all pavements. Some repair work is being done on the cobble pavements now remaining, but the worst of them have been taken up and the new pavements have become so scattered over the city that it is possible to drive and to truck in almost any direction on a good modern pavement. Consequently, the cobblestone pavements receive very little traffic and require very little maintenance, or rather they can be endured with very little repairs.

During the past season eight large stone crushers have been engaged in crushing cobbletone in the Borough of Brooklyn, and so great has been

Diagram Showing Mileage of Pavements From Jan. 1st 1880 to Oct 1st 1903.



the demand for broken stone for use in making concrete, that the demand for construction purposes has been even greater than that supplied.

In working this transformation of the cobblestone into the modern pavement, there are now employed in the Borough of Brooklyn on an average 1757 men and 386 teams. If to these could be added the number of men who are engaged in the manufacture of materials used in this work, the number would be increased fully 50%.

In presenting this brief paper, it has been the endeavor of the writer to give to the Society some idea of the magnitude of the work of changing the cobblestone pavement of Brooklyn to the modern pavement, and also how rapidly it is being accomplished.

RECENT PRACTICE IN RECTANGULAR WOODEN BLOCK PAVEMENTS IN NEW YORK.

BY F. A. KUMMER, GEN'L MANAGER U. S. WOOD PRESERVING CO., NEW YORK.

Owing to the considerable area of wood paving which has been laid within the limits of Greater New York within the past year, the writer has thought that some mention of the specifications under which the work had been done would be of interest to this Society.

The work done may be broadly divided into two general classes: First, ordinary street paving work; second, bridge floors.

The specifications under which all of the street paving work in the city has been done, resemble in many respects the specifications used during the past two years for laying asphalt blocks, but do not resemble in any way the specifications heretofore used for wood paving.

The street work in question comprises extensive contracts on a number of streets recently finished in the Borough of Brooklyn, including a street in the Navy Yard, and several streets in the Borough of Manhattan, on which bids are now being asked.

The bridge work referred to comprises the Washington Avenue bridge, the Metropolitan Avenue bridge over Newton Creek, and the Meeker Avenue bridge over the same in Brooklyn, and the New East River bridge between New York and Brooklyn, the latter having an area of 12,410 square yards.

Although most of the streets in question have a considerable—and in two instances, heavy travel, no greater depth of concrete was used than 5", and the actual depth of concrete bed laid was really 4½". This concrete is of Portland cement with three parts sand and six parts broken stone. The clauses from the specifications for same being as follows:

"The concrete shall be made of the best quality of Portland cement, samples of which must be submitted at least ten (10) days (Sundays and holidays excluded) before using, for the inspection and approval of the Chief engineer. All cement shall be of a uniform quality, color and weight, and briquettes of one (1) square inch section shall develop or exceed the following tensile strength:

Neat—4 hours in moist air, 20 hours in water....200 pounds
Neat-1 day in air, six days in water.............400 pounds
1 of cement, 3 of sand, 1 day in air, 6 days in water 150 pounds

"The concrete shall be composed of 1 part cement, 3 parts sand and 6 parts broken stone. The unit of measure shall be the barrel of cement as packed and received from the manufacturer.

"The sand shall be clean, coarse and sharp and be free from loam or dirt. The broken stone shall be of trap, granite or limestone or such other stone taken from the line of work as shall be satisfactory in the judgment of the engineer. It shall be entirely free from dust and dirt, and be of graded sizes such that all will pass through a revolving circular screen, having holes two and one-half inches in diameter and retained by a screen having holes one-half inch in diameter; provided, however, that equal parts of broken stone and clean washed gravel of a size and character satisfactory to the engineer may be used. The sand and stone shall be placed upon board platforms and be kept free from dirt, and the cement shall be properly blocked up and protected from dampness.

The sand and cement shall be mixed dry, then made into mortar by the addition of water, when the broken stone shall be added and the whole mass thoroughly mixed. The concrete shall then be spread upon the subgrade and rammed so as to fill all the voids of the stone with mortar and bring the surface exactly 4½ inches below the finished pavement. If a machine be used for mixing, the above operation may be varied as may be required. No concrete shall be used that has been mixed more than one-half hour. The concrete shall be protected from the weather when deemed necessary by the engineer.

"No horses, carting or wheeling shall be allowed on the concrete before the same has set, except on planks furnished and laid by the contractor."

Upon the surface of the concrete foundation so laid, a mortar bed composed of one part slow-setting Portland cement and four parts clean, sharp sand shall be spread. This mortar bed is one-half inch thick, and it will thus be seen that added to the 4½ inches of concrete, the actual base of concrete secured is really five inches. This mortar was thoroughly mixed as the work progressed and spread upon the wetted surface of the concrete and was then brought to a true bed by a wooden template. On this bed the wooden blocks were quickly laid and tightly tamped with a wooden hammer until they presented a true and even surface; this ramming being done not upon the surface of the blocks themselves, but upon two-inch planks laid upon the paving surface.

After being so laid the joints between the blocks were filled with a very clean, fine, white sand, which peculiarly enough happened to be ballast sand and came from the shores of the Mediterranean. In anv event, it proved a very serviceable material for this purpose, as it tightly filled all the joints and completely excluded any water from between the blocks.

The following are the specifications for the wood block and the method of laying same:

"The wearing surface shall be composed of long leaf, all heart, yellow pine blocks, treated as hereinafter described. All blocks shall be of sound timber, free from bark, sapwood, loose or rotten knots, or other defects which shall be detrimental to the life of the block or interfere with its laying. No second-growth timber will be allowed.

"The blocks are to be treated throughout with an antiseptic and waterproof mixture, at least 50 per cent. of which shall be dead oil of coal tar, commonly known as creosote oil. The remainder to be resin or some other similar and suitable waterproof material. All portions of each individual block shall be thoroughly treated with the mixture, and after treatment the specific gravity of the blocks shall be greater than that of water.

"After treatment the blocks shall show such waterproof qualities that after being dried in an oven at a temperature of 100 degrees for a period of twenty-four hours, weighed, and then immersed in clear water for a period of twenty-four hours and weighed, the gain in weight shall not be greater than ·3 per cent.

"In preparing the blocks to receive the creosote mixture, they shall be placed in an air-tight cylinder in which dry heat is maintained and raised to a temperature of 215 degrees F. for one hour for the purpose of expelling moisture; the heat shall then be increased until it has reached 285 degrees, this heat being maintained until the block is completely sterilized. Application of heat is then to be stopped and the temperature of the cylinder allowed to fall for one hour, or until the same has been reduced to 250 degrees. A vacuum shall then be applied until about 26 inches is reached, and while under this vacuum the creosote mixture shall be run into the cylinder at a temperature from 175 to 200 degrees, after which hydraulic pressure of not less than 200 pounds per square inch shall be maintained until the individual blocks are treated throughout.

"5. Upon the surface of the concrete foundation shall be spread a bed of cement mortar one-half (½) inch in thickness; this mortar surface shall be composed of slow-setting Portland cement and clean, sharp sand, free from pebbles over one-quarter (¼) inch in diameter, and mixed in the proportion of one part cement to four parts of sand. The mortar top shall be stuck to a true surface exactly parallel to the top of the finished pavement.

"6. The blocks shall not be less than 2½inches wide, 7 inches long and 3 inches deep, or 3 inches wides, 8 inches long and 4 inches deep, uniform in depth or thickness. They shall be laid with the grain vertical and at such angle with the curb as the engineer may direct. They shall be laid in parallel courses with as tight joints as possible, each block being firmly imbedded in the mortar bed so as to form a true, even surface. The joints shall then be filled and kept filled with clean, fine sand."

It is, of course, evident with this class of bed that the blocks must be cut to an even depth. On one of the several streets paved by the company (with which the writer is connected) some difficulty was experienced because a certain proportion of the blocks were not cut to an even depth. This was due to an error in shipment from the works, and for a time delayed the work and showed the absolute necessity of having the blocks uniform in depth. In the writer's opinion this form of construction is far superior to the sand cushion. Such a mortar bed adds to the strength of the base, which a sand cushion does not. It admits of no shifting, and if the blocks are tightly and firmly bedded and set in the mortar while moist, it is impossible for any moisture to get under them. It is, of course, absolutely inelastic and would not make a proper foundation for inelastic paving material, such as brick or stone; but wood being in itself very elastic, does not require a cushion between it and the concrete. It is an advantage to the contractor, because it does away with the rolling of the pavement, although, as before mentioned, it makes it necessary to use blocks of absolutely even depth, within, of course, very slight variation. Our experience showed that a variation of possibly ⅛ of an inch in the depth of the block would be taken up by the cement bed, but not more than this, as this mortar does not compress very much and the broad, flat surface of the base of the block does not cause the mortar to flow sidewise, as it is not mixed sufficiently wet for this purpose. If it were, it would be impossible to keep the blocks from sinking to the surface of the concrete by their own weight, or by the weight of men standing on them while paving.

All the streets referred to above, with the exception of the one in the Navy Yard, were paved with blocks four inches deep, and the joints filled with sand. In the opinion of the writer, on streets having any travel to speak of, laid with four-inch block, no better joint than a good sand joint can be secured. The action of the sun draws a small amount of resinous and oily matter from the wood, and this unites with the sand between the blocks and ultimately makes a mastic and perfectly waterproof joint.

The street in the Navy Yard presented an exceptional case. Very moderate travel was anticipated on the street, and it was laid with blocks three inches deep, upon a sand cushion. These blocks were 2½ inches wide and 6 inches long, and owing to their small size and the manner in which the cushion was made, it was deemed advisable to fill the joints of this street with paving pitch, which was done, thereby excluding all moisture from the sand cushion.

With reference to the size of the blocks: the standard size at first adopted for this work was a block 4 inches wide, 4 inches deep and 8 inches long, and the blocks for lighter travel were 2½ inches wide 3 inches deep and 6 inches long and in some cases 8 inches long. It was soon found that there was a tendency on the part of careless workmen to lay the four-inch block with the grain horizontal instead of vertical, the block being four inches on each dimension, and for this reason, as well as because a better grade of lumber may more easily be secured in the smaller sizes, it was decided to change the standard size to a block 3 inches wide, 4 inches deep and 8 inches long. So, while the length and depth of the block remain the same, the width was reduced from 4 to 3 inches. Such a block cannot be laid the wrong way in the street, and while it presents more joints to the square yard, will, in the writer's opinion, make fully as lasting and a somewhat better appearing pavement. It should be noted here that the standard size block used in England is 3 inches by 9 inches on its surface, being identical with the new standard block just referred to in width, but one inch longer. In laying narrow streets with considerable crown, this one inch additional length is a disadvantage.

The size of the block 3 inches deep was increased on its surface from 2½ inches to 3 inches wide and from 6 inches to 8 inches long, so that the 3 inch and 4 inch blocks are both of the same area on the paving surface and both require 54 to lay a square yard.

With reference to the joints, the writer believes that all streets laid with sand cushion and having very light travel, should have the joints filled with paving pitch to exclude moisture from the sand cushion.

Although some of the streets laid in Brooklyn had a considerable grade, Clinton Avenue, for instance, having a grade of about 2½%, smooth block were used on all of them with the exception of two blocks on State street, where the grooved block was used.

This block is similar to the standard smooth block, except that it has a groove on one edge ¼ of an inch wide and extending downward along the joint 1¼ inches, so that when the blocks are placed together the plain side of each block butting against the grooved side of the adjoining block, makes a joint ¼ of an inch wide and 1¼ inches deep, below which the remaining depth of the blocks are solidly in contact. This joint, filled with sand, as in the case of the smooth block, allows the shoes of horses to obtain a slight foothold and obviates entirely any question of this pavement being slippery on grades. This assertion is positively made because somewhat over two years ago several blocks of the main street in Springfield, Mass., were laid with smooth block, and for a portion of the length of the street were on quite a steep grade, somewhat over 3%, and many complaints were made on the part of horse owners that the street was slippery. A contract having been awarded to the company with which the writer is connected during the present summer to pave three thousand additional yards on said Main street, the company at its own expense removed the smooth block from the grade in question and replaced some with grooved block, and have since been assured that all question of slipperyness has been done away with. As evidencing the slight wear on these blocks, it may be noted here that all of the block taken from this grade, which had been down two years under very heavy traffic on the main street of the city, were subsequently relaid in the three thousand yards of work above referred to, and had worn down, or compressed so little that they could with perfect readiness be used along with the block fresh from the factory. Careful measurement of the amount of wear—or in the opinion of the writer, compression,, of the blocks during this period of two years shows a uniform reduction in the depth of not quite 1-16 of an inch, which would give the block a life of 16 years, provided this rate of wear was maintained. Inasmuch, however, as the action of heavy traffic had been to compress the upper fibers of the block, thereby rendering them much more solid, it is the opinion of the writer that this rate of wear would not be maintained, and that the paving on that street would wear almost indefinitely.

On one street laid in Brooklyn, which was a private job laid with the small block 3 inches deep and 2½ inches wide by 6 inches long, on a sand cushion, peculiar conditions existed. After the street had been laid and the joints filled with sand, a long hot, dry spell ensued, during which there was practically no rain for fifty days, and this was immediately followed by very heavy rains lasting for a considerable period. The result was that the sand cushion under the blocks became thoroughly wet and the blocks were in effect standing in pools of water. The street had almost no travel on it and there was no tendency therefore, for the sand to be thoroughly shaken and packed in the joints, or for the joints to become unified under travel, and the result was that a slight amount of absorption and swelling took place, spoiling the surface of the street to some extent. This section of pavement was relaid, and at that time the writer reached the conclusion that under the conditions, with block of such small area laid on sand cushion with practically no travel on the street, the joints should be filled with paving pitch, and subsequently, as above stated this was done at the work in the Navy Yard with perfect results.

No evidence has ever yet been found of any blocks 4 inches deep on any streets of any travel at all being affected by moisture. And even with the explanation above made, the writer is somewhat at a loss to understand why this particular street acted in just the way it did.

The streets in the Borough of Manhattan for which bids are now being asked for paving with wood block, are Warren Street, from Broadway to Greenwich Street, 4,790 square yards; Twentith Street from Broadway to Fifth Avenue, 1,000 square yards; 98th Street, from Central Park, West, to Amsterdam Avenue, 5,490 square yards.

The principal streets paved in Brooklyn this year were Clinton Avenue, Gallatin Place, Monroe Street, Java Street and State Street, the work on the latter street being a continuation of that done on the same street last year.

BRIDGE FLOORS.

The bridge floors laid with wood block above referred to were laid in two different ways: The small bridges enumerated were all laid on creosoted plank decks 3 inches thick. These decks were all in place and had been in place for some years before the wood blocks were placed upon them. When the specifications for the work were being prepared, it became evident to the writer that, owing to the slight warping of the planks in these decks, it would not result in a thoroughly satisfactory job to lay the blocks directlv thereone, but the street railroad tracks crossing these bridges were only 3 inches deep and it became evident that if the bridges were to be paved with wood blocks at all, they could only be paved with a block 3 inches deep, set directly upon the planking, unless the railroad company would raise their rail, and this they refused to do. The three bridges were therefore paved with 3-inch block set directly on the above-mentioned planking, and the result as anticipated has occurred: these results being that in many instances blocks which do not lay firmly on the planking have been cracked by the extremely heavy traffic, one of these bridges alone having over four thousand heavily loaded teams per day. At the same time, the surface of these bridges has been perfect, and the cracking of individual blocks has not apparently injured the integrity of the pavement in any way. The blocks being thoroughly treated throughout, the admission of moisture or air containing germs of decay to the heart of the block is of no importance, and the paving being laid very tight, presents a smooth surface, resembling very much that of asphalt, so that the joints and cracks above mentioned are only apparent upon careful inspection. At the same time, the writer cannot recommend this form of construction except in cases where it cannot in any way be avoided. A number of other bridges, notably in Lowell, Waltham and Chicopee, Mass., and Baltimore, Md., and elsewhere both 3 inches and 4 inches deep, and in a majority of cases it was found desirable to cover the decking of the bridge with a coating of paving pitch, applied hot, upon which was spread a light sand cushion of sufficient thickness to take up any inequalities in the planking. The object of applying the pitch to the decking before putting on the sand cushion was to prevent the sand cushion from running through the cracks between the planks, as would otherwise have been the case.

Work on the New East River, or Williamsburg bridge, is under way at present time. These blocks are 4 inches deep and of the 12,410 square yards embraced in the structure over ¾ of the area will be laid with grooved blocks. These grooved blocks extend from the anchorages up to a point three hundred feet from the center of the bridge. The blocks on this portion of the bridge are grooved because of the grade. The six hundred feet directly in the center of the span being approximately level, is laid with the plain block. The paving surface is set directly upon the steel floor formed by laying 3x12 channels, side by side and lengthwise of the bridge. These channels rest directly upon the floor beams of the structure and are laid about one inch apart and are fastened to each floor beam with a bent plate. Across the tops of these channels at right angles to the line of the roadway every ten feet are bolted ¼ inch angle irons 2 inches on the flat and 1 inch high, with horizontal legs turned toward the center of the bridge from each end. The purpose of these angles is to divide the pavement into ten-foot sections, so that should any expansion occur it will be confined within each section. These angles are bolted by means of bolts passing through the slots between the channels, which, as before stated, are separated about 1 inch. It is intended to pave each ten-foot section separately, and when it has been paved to close it up by means of the angle irons, these irons being driven tightly against the last course of block in each section and bolted into place. The first course of block in each ten-foot section are grooved so as to fit over the leg of the angle iron. In this way each ten foot section of each roadway, of which there are two, is made an independent area. While there is no probability of any expansion occurring, still should same occur it would be confined to each particular enclosed area.

Before laying the blocks on the steel channels, the surface of same is being coated with a thick coat of paving pitch and the blocks are set in this while same is hot.

In the case of the grooved blocks, the joint is filled with very fine gravel and the surface then covered with hot paving pitch, which is swept into the joints so as to fill in and around the gravel and bring the joints flush to the top of the block. The same form of filling is used on the six hundred foot section of plain, ungrooved block, except that no gravel is used. The whole surface of the roadway after pitching will be covered with a light dressing of fine sand.

The work of carrying out this contract has been considerably delayed on the part of the steel contractors and it is open to some question whether the weather will admit of its completion this fall. All of the material for this work is being hoisted from the docks at the base of the middle towers by means of derricks and all of the distribution of the paving material on the structure is taking place over the completed pavement by means of push carts pushed by hand.

The writer is of the opinion that the specifications under which this piece of work is being done are the very best specification which can possibly be drawn up for paving a bridge floor where it is not desired to use buckle plates. If a buckle plate floor is used, the writer would recommend a cement mortar bed on top of the concrete used in the buckle plates, with the addition of a pitch joint in case of bridges over one hundred feet long, or those laid with 3 inch block—that is, block 3 inches deep.

SOME REMARKS ON THE COST OF BRICK PAVEMENTS AT ATCHISON, KANSAS.

BY FRED GIDDINGS, CITY ENGINEER, ATCHISON, KANSAS.

In the year 1887 the city of Atchison, Kansas, laid the first brick pavement west of the Mississippi river. The bricks were made at Galesburg, Ill. The pavement consisted of two courses, the bottom course on three inches of sand, with one inch sand cushion between the courses and sand filler. There was laid 12,982 square yards at $2.00 per yard and costing $25,963.80. This pavement is in excellent condition.

In the year 1888—there was laid 2470 yards of similar pavement at $2.18 per yard costing $5,385.15. A very excellent bed of shale having been found at Atchison, the manufacture of paving brick was commenced, and 2704 3-10 yards of Atchison brick was laid at $2.05 per yard, costing $5,543.82. Owing to the inexperience of the makers, this pavement did not give good satisfaction, but with some repairs the street, which is in the business part of the city and subject to fairly heavy travel, is still giving good service. Since this time all bricks laid in the city are of Atchison manufacture. The bricks are of excellent quality and are equal to any brick manufactured west of the Mississippi river.

In 1889 there was laid 32,221 square yards of two course paving at a cost of $59,804.20, an average of $1.856 per square yard.

In 1890—24,186 square yards, costing $46,324.22, averaging $1.915 per square yard.

In 1891—1,866 square yards, costing $3,140.78—$1.683 per square yard.

During the years 1892 and '93 there was no paving done.

In 1894 paving was resumed, during this year an old macadam street was repaved with one course of brick at a cost of $16,743.36—.92 per square yard.

This price did not include the breaking up and levelling of the old macadam and furnishing additional rock—Sand filler was used—The old macadam after being picked up was well rolled with a horse roller, and the bricks were laid on a sand cushion one inch in depth. This street is in excellent condition, is subject to medium heavy travel, and is nearly equal to a concrete base.

In 1895 there was a demand from property owners for a less expensive pavement and it was decided to experiment with a pavement consisting of one course of brick on three inch sand foundation, accordingly there was laid 3,051 square yards of such pavement at a cost of $2,893.43—.94 8-10 per square yard. This price included the sub-grading, dressing and rolling the sub-grade, and compared very favorably with the average price paid in 1891, viz.: $1.683 per square yard.

The method of paving was as follows: After the street was brought to the proper sub-grade, it was rolled with a horse roller weighing about 150 pounds per inch, a sufficient quantity of sand being distributed, the sand bed was formed by dragging a guide board shaped to the contour of the street, one end of said guide board resting on the curb, the other on a plank set in the center of street. The guide board was dragged over the sand several times, until the bed was firm and parallel to the finished surface, on which bed the bricks were laid at right angles to the line of street, the pavement was then swept off, all defective bricks removed and each course forced up tight with a bar before making the closure at the curb, after which the pavement was rolled with a light roller until the bricks were brought to a smooth and firm surface; dry sand was then broomed in until all joints were filled. The surface was then covered with ½ inch of sand and opened to traffic. This pavement is in good condition, has answered the purpose for which it was laid and the property owners are well satisfied with it.

During 1896 there was laid 19,532 square yards of similar pavement, costing $15,951.54—.81 7-10 per yard. There was also laid 4,247 yards on old macadam costing $3,610.35—.854 per yard.

In 1897— a street paved with cedar blocks on concrete foundation was repaved with brick 16,521 square yards, costing $11,548.40—.69 9-10 per yard. This price included the removal of the old blocks and furnishing sufficient sand to bring the pavement to grade. Depth of blocks having been seven inches, required about three inches of sand.

In 1898—Single course paving on sand foundation was resumed—11,303 square yards being laid, costing $7,915.81—.70 per square yard, a reduction of .11 7-10 per yard from the price prevailing in 1896.

This paving is in good condition and, being on a residential street, will last for many years.

In 1899 there was laid 34,853 square yards of similar pavement, costing $25,352.45—.72 7-10 per square yard, an average of .2 7-10 per yard over 1898. All now are in good condition.

During 1900, we laid 2,916 yards on old macadam, costing $2,449.82, or .84 per yard, and 20,424 yards on sand costing $18,054.49—.88 4-10 per ard. A portion of the pavement laid this year has not been satisfactory. A street containing 1,764 yards was situated on bottom land, and owing to the bursting of a water main had been thoroughly saturated and immediately upon its completion, had been subject to travel by heavily loaded wagons from a foundry, mill and other factories, and in spite of frequent repairs the pavement got into such bad condition that it became necessary this year to remove the bricks and lay a second course on the flat. Another street has also required some repairs—bad spots have been taken up the poor material removed and a foundation of cinders well tamped substituted.

In 1901 there was laid 22,638 square yards, one course pavement on three inch sand foundation, costing $18,886.86 or .83 4-10 per yard. This pavement is all in excellent condition and is showing the ability of this character of paving to withstand heavy traffic, and I would state that one of the streets paved forms the contiuuation of a principal thoroughfare leading into the city over which is hauled heavy loads of wheat and corn in narrow tired wagons. A large state institution is also located on this road, over which all coal used is hauled by four horse teams. The street is twenty-five feet wide between curb and stands up well under this traffic.

In 1902—26,454 yards of this pavement was laid, costing $21,127.68 —.79 8-10 per square yard. This pavement has been down too short a time to pass on its merits, a portion of it was laid on a twenty-five foot fill and may cause trouble from settlement, so far the pavement is in excellent contion.

This year there has been laid 4,728 yards paving on sand, costing $4,008.73, an average of .84 8-10 per yard and there is now under contract and nearly completed 12,700 yards on six-inch concrete base at $1.48 per yard and 21,900 yards on broken stone foundation at $1.13 per yard, both repressed brick. The latter is of minimum depth of six inches, broken stone. Size, 2½ inches, the voids being filled with limestone screenings and well rolled with a fifteen ton roller. This makes a first-class foundation, almost equal to concrete at thirty-five cents less per yard. However, there was considerable macadam on the street which reduced the cost.

We have lately let contracts as follows: 19,098 yards at $1.27½, on old concrete foundation, which will be raised on an average five inches, with broken stone and screenings, Portland cement filler with expansion joints. Also 13,502 square yards two course paving at $1.447 and 2,300 yards on broken stone at $1.195.

The price of paving brick is $11.00 for repressed, and $10.00 for common pavers at the kiln. The cost of hauling is from .75 to $1.00 per thousand.

In conclusion, I would say, that one course brick paving on a sand foundation makes a cheap, durable and satisfactory pavement for residential streets of moderate traffic when the soil is suitable, that such pavements may be laid on steep grades; we have one street with a grade of thirteen per cent. This type of pavement should not be laid on flat-bottom lands where the soil is unstable. I am of the opinion that it would be well to substitute for the three inch sand foundation, three inches of cinders well rolled with one inch sand cushion. I found in taking up the failed pavement previously mentioned, that the places where repair of cinders had been made were extremely hard and difficult to loosen with a pick.

MEDINA SANDSTONE PAVEMENTS IN BROOKLYN, N. Y.

BY C. D. POLLOCK, ASS'T CITY ENGINEER, BUREAU OF HIGHWAYS, BROOKLYN. N. Y.

Last year Brooklyn tried several new kinds of pavements, that is, they were new in Brooklyn. Among these were two contracts for laying Medina sandstone pavements on a concrete foundation.

These pavements were laid under practically the same specifications as our standard granite block pavement. except for the dimensions of the blocks, closeness of joints and the size of gravel.

Tar and gravel joints were used. This necessitated fairly open joints between courses, ½ inch was the maximum allowed. These pavements are wearing flat on the surface after 1 years' use, but the joints become rather too prominent.

This year all our Medina block pavements have been laid with joints of Portland cement and sand in the proportion of 1 to 1, mixed to a fairly liquid grout. Although this method has had only a few months' test in Brooklyn, the indications are that this will give us a much better result than where we used more open joints and tar and gravel as a filler.

This season we have used Medina curb and bridging with the Medina block pavement.

Our curb is set in Portland cement concrete, a bed of 6 inches underneath the curbstone and six inches in front and same behind it.

The foundation for the pavement is 6 inches of concrete mixed in the proportion of 1 Portland cement, 3 parts clean, sharp sand and 6 parts stone.

On this foundation there is spread a bed of clean, coarse sand to a depth of 1½ inches, and then the blocks are laid acording to the following specifications; the tar and gravel joints applying to the 1902 contracts and the cement joints to those of 1903:

SANDSTONE PAVEMENTS.

BRIDGESTONES—When required, old bridgestones shall be redressed, rejointed and relaid as hereinafter directed for new bridgestones and for such purpose shall be hauled to the necessary point or points by the contractor. Bridgestones broken by being so hauled, redressed or relaid shall be replaced by the contractor at his own expense.

New bridgestones shall conform as to dimension with the specification for granite bridgestones as contained in paragraph 36. They shall be of the same quality of stone as the blocks, free from all imperfections.

The top shall be dressed to a surface not varying in evenness more than one-quarter (¼) of an inch. The sides and ends shall be dressed square down and the latter cut to a transverse bevel of six (6) inches in the width or to such other bevel as may be directed, and the adjoining from the top to bottom shall give joints not greater than one-quarter (¼) of an inch.

Paving blocks shall consist of the best quality of Medina sandstone, free from quarry checks or cracks, and shall be quarried from fine grain, live rock, showing a straight and even fracture. The material shall be of uniform quality and texture, free from seams or lines of clay or other substances which, in the opinion of the chief engineer, would be injurious to its use as paving material.

Blocks shall measure not less than three and one-half (3½) nor more than five and one-half (5½) inches thick, and not less than six (6) nor more than six and one-half (6½) inches deep and from seven (7) to twelve (12) inches in length. Stones to have parallel sides and ends and right angle joints. All roughness in joints or stones to be broken off so that when set in place they shall have tight joints for a distance of at least three and one-half (3½) inches from the top down, the top to have a smooth, even surface with no projection or depression exceeding one-quarter (¼) of an inch.

Upon the bed of sand the stone blocks and crosswalks must be laid. The stone blocks to be laid in straight courses, at right angles with the line of the street, except in intersection of streets (including the space within the railroad tracks) when the courses shall be laid diagonally, except in special cases, when they shall be laid at such angle, with such crown, and at such grades as the chief engineer may direct. Each course of blocks shall be of uniform width and depth, and shall be gauged and selected for the pavers, on the sidewalks, and so laid that all longitudinal joints or end joints shall be close joints and shall be broken by a lap of at least three (3) inches, and that joints between courses shall be not more than one-half (½) inch in width top and bottom. As the blocks are laid they shall be covered immediately with clean, hard, hot, dry, gravel, artificially dried, and shall be brushed into the joints to a depth of three (3) inches. The blocks shall then be thoroughly rammed by courses at least three times by a rammer, weighing not less than eighty (80) pounds—no iron of any kind being allowed on its lower face to come in contact with the paving, and until brought to an unyielding bearing, with a uniform surface, true to the roadway or the established grade.

The joints shall then be filled with clean, dry, hot gravel, of proper size as herein specified, heated in pans especially provided for that purpose and poured from cans having small spouts, and thoroughly settled in place with wire picks, until the level of the gravel is at least two (2) inches below the top of the pavement.

The gravel used between the blocks shall be of such size as will pass through a sieve having four (4) meshes per square inch, and be retained on a sieve having sixty-four (64) meshes per square inch, and must be screened dry.

There shall then be immediately poured into the joints, while the gravel is still hot, boiling paving cement, as hereinbefore described, heated to a temperature of 300 degrees Fahrenheit, until the joints and all interstices of gravel filling are full and will take no more and are filled flush with the top of the blocks. Dry, hot gravel must then be poured along the joints, filled with paving cement as above described.

When Portland cement is used in the joints the blocks shall be laid as closely as possible and after having been rammed till they are brought to a firm bearing and an even surface, a grout made of equal parts of Portland cement and clean, sharp sand shall be poured upon the surface of the pavement and swept into the joints, and this process repeated until all the joints are completely filled and remain full.

The cement joints bind the blocks together very thoroughly. Wherever we have had occasion to take out any blocks after the joints have become well set, the blocks have broken as readily as the joints, in fact, we have obtained practically a solid pavement. It is smooth and yet not slippery.

The requirements for the cement used in the joints are as follows:

> The cement used must develp or exceed the following tensile strength per square inch:
>
> Neat—four hours in moist air, 20 hours in water ....225 pounds
> Neat—one day in air, 6 days in water.......500 pounds
> One part cement, two parts standard sand by weight, one day in air, 6 days in water....225 pounds

In grouting the joints we have found that one barrel of cement will go from 12 to 13 square yards of pavement, depending upon the run of the blocks and also upon the sand underneath. When the sand bed is composed of a course, rather even grained sand, more of the grout runs under the blocks than if the grains of sand are well graded. On a street where our granite pavers average about 55 square yards per man per day, the same men pave about 45 square yards of Medina blocks.

Because of the greater latitude allowed in width of Medina blocks, the paver is obliged to be more careful in selecting stone to keep his course even and close.

The prices bid for Medina sandstone pavement with Portland cement joints are practically the same as for granite with tar and gravel joints.

The average price of the two contracts of 1902 was $2.41 per square yard for the paving, including the joints, and the average of the five contracts this year is $2.87. The average price bid on four granite contracts at about the same time as these last is $2.80. These prices are all exclusive of the foundation.

The total amount of Medina block pavement either completed or under contract in Brooklyn is a little over 44,000 square yards, or which over one-half is completed at the present time.

In the Medina sandstone pavement we have a surface between that of sheet asphalt and that of granite blocks, hence it seems to the writer that its field in Brooklyn will be mainly on residence or semi-residence streets where the grade is too great for street asphalt and yet it is desirable to have a smoother and less noisy pavement than granite.

A DESCRIPTIVE DISCUSSION OF THE BITULITHIC PAVEMENT, AND THE METHOD OF ITS CONSTRUCTION.

BY C. A. KENYON, INDIANAPOLIS, IND.

When this pavement was first invented, it was called Warren's Bituminous Macadam Pavement. The name was deceptive. It led many well-meaning people to believe that it was made by mixing bitumen with macadam stone, and laying it as any macadam is laid. Opponents of the pavement, immediately declared, amongst other things, that there was nothing new about that, and that the claim of Mr. Warren that he had invented a new pavement called Bituminous Macadam, was mere pretense, that the mixing of bitumen and broken stone was so simple that it required no inventive talent to do it, and that it was absurd to claim that such a mixture was patentable. The name, together with these plausible, but malicious statements, had a tendency to deceive those who did not carefully look into the pavement and its construction. A name was therefore selected that was entirely new, one that could not be used to deceive people by the enemies of the pavement, and it was called Warren's Bithulithic Pavement.

It is true that it is made of broken stone and bitumen, but for all that, it is no more like ordinary macadam roadway than the best Haviland china is like ordinary building tile, because they are both made out of clay, or a building stone is like a beautiful statue because both were made out of marble.

It did not take engineers, public officials and property owners long to see the difference, and to see the advance which had been made in pavement construction, as is evidenced by the following statement of the amount of the bitulithic pavement laid in the United States in the short time since its discovery, and I predict that the demand for the pavement in 1904 will be double that of 1903.

There was laid in 1901, in 6 cities............	14,400	sq. yds.
There was laid in 1902, in 35 cities............	440,831	"
There were contracted for, in 1903 to July 15th..	858,999	"
In less than 3 years..........................	1,314,230	sq. yds.

You will agree with me, that this is an unprecedented record, especiallly considering the opposition from opposing paving interests that had become intrenched, and from conservative doubters that always exist.

In discussing methods of construction, I will commence with

THE FOUNDATION.

The sub-foundation should be prepared the same as for any other pavement; soft and spongy places in the grade should be removed and filled with proper material, and the grade should be thoroughly rolled unless the foundation is so sandy that it will not pack, in which event, rolling is an injury rather than a benefit. I believe that the best method of treating such a foundation, is to bring it to a grade (full) and flush it with water, and over this, spread a thin layer of marsh, or other tough hay or straw, one inch thick, evenly distributed. Upon this spread the crushed macadam stone, broken so that the sizes are from 1 inch to 3 inches in diameter, the dust and screenings should be removed. If it will not increase the cost too much, place the coarsest stone at the bottom and roll and then top dress and bring to true grade with the one inch stone.

Over this, sprinkle lightly, the Number One Composition which is very fluid, and is for the purpose of aiding the strong, stiff, Number 24 Composition to adhere to the cold stone, and it is reheated by the application and rolling of the Wearing Surface, to penetrate between the stones of the base and bind them together and make them foundation waterproof.

The Number 24 Composition should be heated to a temperature of from 200 to 260° F., and care should be taken not to burn it, and equal care should be taken to have it equally distributed over the surface. Pools, or excessive amounts are not desirable, although I have as yet discovered no ill effects from this cause in the few instances I have noted.

Some, advocate rolling this foundation, while others hold to the contrary view. If the foundation has been thoroughly rolled, I see little use or harm in it. The contractor sometimes wants to roll it, as less of the surface mixture will be required, especially if the foundation is rough and the stone coarse.

Some engineers have felt that the pavement would be better with a hydraulic concrete foundation, and opponents of the pavement have sought to decry it, because such a foundation was not provided, but, I believe that in nearly every instance, such opinions were arrived at by academic reasoning, and have not the facts of experience back of them.

I believe that with a reasonably solid sub-foundation, properly prepared, that the bituminous foundation will be found to be superior to the concrete foundation, for the following reasons:

(a) The broken stone is wedged together by the great pressure of the heavy rollers, and the under surface fitted under pressure into all of the inequalities of the sub-grade if it will carry a fifteen ton road roller. Such a foundation will carry any load that will be hauled over it.

The hydraulic foundations are merely dumped onto the grade and lightly tamped, and such a foundation has not an even bearing, and is not fitted to the inequalities of the sub-grade. Few such foundations would withstand a fifteen ton road roller passing over them, without damage.

(b) The bituminous is more elastic than the concrete foundation, and hence is better for the wearing surface as being homogeneous with it, and firmly uniting it.

(c) If the sub-foundation under a hydraulic concrete pavement base is wet, the concrete draws itself full of water, by capillary attraction. In winter the water in the concrete freezes and expands and contracts, to the injury of the foundation and wearing surface over it, especially is this true, when the wearing surface is asphalt or wood blocks. This has been demonstrated beyond question. Such a thing cannot happen with the bituminous foundation, for the reason first, that the spaces between the stones of the foundation are too large to permit of capillary attraction, and second, the bituminous coating is entirely impervious to, and not affected by, water. If the water had such a head, as to rise between the stones (which would be a very unusual thing) and freeze, I do not believe it could do any harm. It could not break any part of the pavement by expansion or contraction because of the elasticity of the foundation, as well as the top.

(d) Bituminous foundations have proven their value by experience, for many have been in use in Washington, D. C., and other cities of this Country, for over thirty years, and are giving perfect service at this time. I have examined many of them myself, and have talked with engineers and constructors who are familiar with them, as well as having consulted engineering books, and I have not known or heard, or read of any well authenticated, specific instance where a well laid bituminous foundation for a street pavement has been other than sucessful.

We now come to the selection of materials, the preparation and laying of the wearing surface of the bitulithic pavement.

To get the perfect wearing surface, the genius of the inventor, the art and thoroughness of the constructor, the intelligent watchfulness of the engineer, all are taxed to their utmost.

Let me halt a little in this descriptive discussion, and recall to your minds almost conflicting combination of qualities, that the best authorities tell us should be united in the perfect pavement surface.

Mr Tillson names them, and gives each quality its percentage value as follows:

Cheapness	14%
Durability	21%
Ease of cleaning	15%
Light resistance to traffic	15%
Non-slipperiness	7%
Ease of maintenance	10%
Favorableness to travel	5%
Sanitariness	13%
	100%

The nearest that any pavement he names, comes to these conditions, is asphalt 76%; brick 67%. A recent writer in Municipal Engineer on the same basis, gives the bitulithic pavement 82%.

Mr. Baker in his work on "Roads and Pavements" gives a table with some slight differences in the percentages of values of these qualities, and his judgment gives asphalt, 77 per cent.; brick, 70 per cent.; and the writer in Municipal Engineer referred to, gives the bithulithic pavement on the same basis, 88%.

Many who have studied the construction, and watched the results of the bitulithic pavement, believe that its inventor discovered a construction that comes nearer meeting all these requirements, than any other form or method of construction in practice at this time.

THE THEORY.

of the inventor, in short, was as follows: First, to get a material for the wearing surface that was universally available and durable, at moderate cost. Hard stone was selected (the harder the better). Stone had long been in use in block form, and as macadam. You know the objections to the material in both forms.

The theory worked out was to crush the stone into a variety of sizes, ranging from pieces 1½ inches in diameter, to an impalpable powder; to predetermine the requisite quantity by weight of each size, that when all properly mixed together, the smaller stones are properly distributed in and occupying the voids between the large stones. and the still smaller stones performing a like function in the voids which they should occupy and so on, down to the finest dust, thus making a mixture of the various pieces that in density was within 10% of the solid stone before it was broken into pieces; then covering completely each particle of such stone mixture, large and small, with a heated elastic waterproof bituminous cement, sufficient to fill the remaining voids and make the densest mixture practicable. Such a mixture, it was thought, could be laid in a sheet on the street, and produce a dense, smooth, durable surface, with a good foothold for horses, and one that could be easily and cheaply repaired and cleaned.

Such a result was worked out in the laboratory, with results beyond expectations, but when an effort was made to duplicate the result on a large and commercial scale, obstacles appeared and multiplied, and it was only by the most indomitable energy, and perseverance, united with creative ability of a high order, that the theoretical was made practical. A false step anywhere along the line threatened ruin. One of the first, and almost the most important thing, was to secure a good commercial supply of a suitable bituminous cement. Asphalt, coal tar and roofing pitches were on the market, the owner of each thought his material was the best for making pavement, many thought any of them would do, but experience soon showed that there were no suitable cements on the market, that the known asphalt cements were not suitable, hence a cement had to be especially manufactured to obtain the proper results, new machinery, methods and appliances had to be devised or invented.

Another difficulty arose in getting the stone crushed in the proper sizes, and disposing of the rejected sizes. The crusher would not turn out the correct proportion of each size. Few, if any, of the crushing plants had the proper screen arrangement. This increased the cost above expectation. The crusher screened the stone cold, and it was often damp or wet, the fine would adhere to the coarse pieces, and another trouble arose, the proportions would go wrong. Finally it became necessary to devise and invent a screen and storage bin arrangement by which the stone could be separated into sizes, after being heated, and stone of the same size placed in one bin and those of different sizes in other bins, in such a way that the exact amount of each size of stone could be weighed separately, and all placed in the revolving twin-pug mixer, at the same time while heated, after which, the heated bituminous cement had to be weighed on a separate scale and poured into a mixer. After which it was dropped into a wagon and hauled to the street.

Difficulties in loading and unloading the wagons, in placing the same on the street, were almost as numerous. And after the machinery was invented, men had to be trained to operate it, and with each succeeding plant, a new force had to be trained. Analogous difficulties arose over the application of the flush coat, the spreading of the screenings, etc., etc. New problems all along the line. One would think that the asphalt industry would have furnished plenty of experienced men, but it was soon found that the work was so different that workmen from that industry had to unlearn much before they could become efficient in this new work.

THE CEMENT.

The greatest difficulty was in securing a suitable cement, uniform in density and quality. It is now generally recognized as firmly established that the merchantable Trinidad asphaltic cements contain salts soluble in water, and therefore this material was not believed to be lasting or suitable. There were, and are scattered over the country in many cities, small areas of street pavements, and sidewalks laid many years ago, the cementing materials of which was manufactured from coal tar. It was and is true that while these small areas have outlasted any mastic pavements made from other bitumens, that alongside of them, other parts of the pavements or walks supposed to have been made from the same material, disintegrated and went to pieces in a short time. None of the manufacturers of the cement knew why, or if they did, made no effort to remedy the defect, and at the advent of the bitulithic pavement, there were no paving cements manufactured from coal tar on the market. There were some excellent roofing cements, but the paving cements had long since disappeared.

An exhaustive study of coal tar revealed the fact that these old paving cements made from coal tar, lacked

1. Uniformity in the quality of the tar from which the cement was made. Tars from different coals were often placed in the same still.

2. Uniformity in density or viscosity. There was no method in use by which tars of different qualitv could be brought to a uniform degree of quality and density.

3. Approximate uniformity of chemical and physical properties. Coal tar is one of the most complex substances known to chemistry. No one knew what combination of chemical qualities would yield a product with the desired physical qualities or knew how to produce the cement uniformly from the crude materials, so that when the proper chemical combination (approximately) was discovered, there existed no machinery to manufacture it on a commercial scale, and suitable methods and machinery had to be devised to manufacture and test the product.

These difficulties have been overcome and an excellent cement, uniform in quality, chemical and physical, and of a standard, uniform density, is being produced for the purpose of making this pavement. There may be here and there, lapses, now and then an error or mistake is likely to be made, in fact, cannot help being made, but such care is being taken that the chances for mistakes are being reduced to a minimum.

The essential thing is that the defects in the selection of the tars and their manufacture have been discovered, and the means, method and appliances also discovered for remedying the defects. This constitutes a distinct, radical and valuable advance in the paving industry. I am aware the man who has something else to sell, or who is opposing this form of pavement or this industry, has said and will say again, that it is coal tar, and that coal tar is coal tar. Just as when steel was discovered, many still thought it was "just iron," but time will discover all of these things. The skeptic seldom sees the discoverer, the one is at the front, the other in the rear of the procession.

It is reasonably certain that the Puritan Brand of cements, if the present standard is maintained, and there is every reason why it should be and be improved—will last as a cement until the stone which is cemented together by it, into a pavement, is worn out. The cement is not affected by water and therefore renders the pavement perfectly waterproof.

When the wearing surface of a street pavement is made of the materials and in the manner I have described, it has great density, and approaches very nearly to a solid. Graded stone has from 9 to 11% of voids. Graded sand has from 27 to 35% of voids. In the stone mixture, the inherent stability of the stone permits the use of a softer cement, one with more life—one less affected by cold—more elastic. The cement fills all the voids and is not subject to attack by air and water in minute particles, as it would be if a sand mixture instead of a stone mixture were used.

The stone mixture graded as described has about one-tenth the surface area of particles that graded sand of the same volume has. If the same amount of bituminous cement is mixed with an equal volume of graded stone as is mixed with the graded sand, the coating of the cement on the stone particles, must approximate ten times the thickness it would on the graded sand, and therefore, if exposed, should endure ten times as long. This advantage will be apparent to the *a priori* observer.

The stone offers a rougher surface to horses and is proving successful on 12% grades. The stone thus cemented together cannot be dislodged, as in macadam. It does not grind under traffic. It cannot be washed away or swept away. It can be easily and cheaply cleaned. It does not get dusty in dry weather.

While it is made of hard stone, which gives it greater wearing qualities, yet, in as much as each of these stone particles is encased in a soft cement, the pavement is very quiet.

As the public becomes better acquainted with its qualities, it grows in popularity. It is reasonable in cost, and from a scientific standpoint, has the endorsement and approval of leading municipal engineers, and officials from over the entire country. It will therefore appear that if the bitulithic pavement is not given over to its enemies, if the present standard of excellence in materials and construction is maintained, if slipshod methods, hybrid specifications and inappropriate materials are not permitted to creep in and destroy it, before its excellence is universally conceded, that inside of five years it will be recognized as the standard pavement of this country.

Mr. Adam: I think the few who have remained here and listened to the reading of the papers had better defer the discussion until this evening.

President Rust: I think we had better discuss these papers now. We have other papers to be read this evening.

Mr. Tillson: Some three or four years ago when returning from Toronto, where I had attended a meeting of this Society, I stopped over a day, and by the kindness of Mr. Fisher had an opportunity to examine the Rochester pavements and at the same time learned the cost of repairs up to that date. I must admit that if I had not seen the pavements, but only saw the cost of repairs, I should not have believed the pavements could be in such good condition as they were. I think the cost is very much less than the cost for repairing in any other city I know anything about. The plan adopted in Brooklyn a year or two ago, of making the repairs and paying for the material by the cubic foot, and have some member of the department locate just where the repairs should be made, I think is a very good one. The little experience we have had in this demonstrates to me that it is the proper way. The contractor will know beforehand just how much work he will have to do in addition to the amount of material he will have to furnish. The price for repairing this year is 95 cents per cubic foot for the surface, and 45 cents a foot for the binder. As far as I was able to ascertain, when making some examinations for a report, I found that the cost of the labor to the company doing the work had been approximately 23 cents a cubic foot. Of course that must be a rough estimate in any event, because if you are using a large amount of material at that price, the cost will be lessened when you are using a small amount of material. In some cases a load will be used up in a mile of street; in other cases it will do the repairs on several miles of street. The average cost for repairs on streets that had no car tracks was 4.18 cents; the cost for repairs on streets that had car tracks in them was 7.8 cents. The average cost of all streets was 6.79 cents. The last contract we had under the old system, when the contract was so much a square yard, including the whole surface of the street, no matter how much work was done, the cost was 15.93 cents, or practically 16 cents. This involves an amount of 698,000 square yards, so you see it is a large item. The cost this year I think is going to be more.

There is another curious fact, and that is that old streets as a whole do not seem to cost much more than the new ones. When I came to examine into this I found we had two long streets in Brooklyn that were laid in 1897 that were bad, and they cost a great deal for repair during the first year.

Mr. Adam: You say the average price under the old contracts was fifteen or sixteen cents. Have you the cost of the pavements where there were no car tracks?

Mr. Tillson: The price under the old plan was the same whether there were street car tracks or not. The bad streets were grouped together and the good streets grouped together, and then the contractors bid on them. We take one group of streets with perhaps 100,000 square yards, 50,000 yards of which might be on a street where there were car tracks, and 50,000 on streets without tracks.

An amusing thing occurred to me when Mr. Kummer's paper on wooden pavements was read. Last year during the coal strike the company laying this block pavement was laying it in a certain part of the city where it was currently reported that one of these blocks was sufficient to get a breakfast. The pavement contains about twelve pounds of creosote oil and ten pounds of resin per square foot. The blocks are so heavy they will sink in water.

MR. ADAM: I would like to make some remarks on the Medina sand stone pavement in regard to the filling and cement grout. I was in Worcester recently and looked at the bithulitic pavements there. I found that in pouring the cement into the joints they poured it over the blocks. That made the pavement so slippery it was worse than the asphalt pavement. In Newark years ago they had the granite block pavement, and they spaced the joints by putting in a strip to keep the joints apart. Afterwards they withdrew this slip, which was of wood, and filled the joints with cement. The people complained of the rigidity of the pavements which caused the transmitting of the jar into their houses. In brick pavements where cement grout is used there is an expansion. Have you given any thought to the fact that the pavement might expand on account of using cement grout in the joints?

MR. TILLSON: I don't believe the expansion would be enough to do that; possibly it might.

I examined the Worcester pavements myself a few years ago. They are laid with a cement joint, and they practically have a solid surface from one curb to the other. I don't believe the expansion of the sandstone is any more than granite, and I doubt if it is as much.

MR. BALLARD: How is it with brick?

MR. TILLSON: I can't say how it is with brick.

MR. ADAM: Now, as to the matter of wooden blocks. I went out with the assistant engineer of this city, and he told me when they first laid the wooden block pavements the blocks expanded. so they had to take away a wagon load of the ones that had expanded. If a cement grout is used in the wooden blocks I think there would be danger of expansion.

In regard to the bithulitic pavement, I differ with Mr. Kenyon. He says it is a bithulitic foundation. From what I have seen of the foundation of that pavement, I should say it was not a bithulitic foundation. Stone is spread on the surface and smaller stone spread over that to make ballast upon it; then the coating is spread over that. It does not penetrate down into the larger stone to make it a bithulitic foundation. One of the complaints made of this foundation is that it only consists of coarse stone and is not filled in with anything, leaving it open so that no moisture can penetrate without making trouble.

Mr. Kenyon: If you will go up on Pennsylvania Street you can see pavement that has been in there fifteen years. It was just put in that same way. If you take the pavement up when it is first laid you will probably discover that the bitumen that was on the top of the foundation is still there. As the years go on the heat of the pavement keeps it going on down. There are some trenches cut across that pavement, and you can see how far it has penetrated. These trenches are in Pennsylvania Street, between Ohio and Market Streets. This street has the same kind of foundation that Washington Street has, and they have all been down fifteen years. The stone was put down and the heated bitumen poured on that. When the streets were resurfaced it was done on this same foundation.

Now I want to say one word in regard to block pavements. I want to speak about their being fire-proof. During the great fire in Chicago there were a great many of these wooden block pavements made of the common red cedar. I suppose no city ever encountered a greater fire than there was there, yet many of these pavements were not destroyed when both sides of the street were leveled to the ground. The reason was given in the paper.

I have had a great deal of experience in laying these pavements. The first one of these pavements that was laid in recent years I think I laid. I was the first one to advocate them in recent years, I think. No other city was using them; they had not begun to use them in the East any place. The first one laid here was put down in 1896. Some thirty years ago, in 1872 or 1873, there was one laid in Galveston, Texas, on Market Street, and one laid at the entrance of the gas works in New Orleans, where they had put the blocks in with creosote that came from distilling the tar.

They laid them at their entrance, and the pavement is used still and is giving good satisfaction. The flood in Galveston, of course, disarranged things there, but the pavement I spoke of in New Orleans is in good condition to-day. There seems to be an idea that the wood can be kept from smelling. I don't believe any process has ever been discovered by which you can keep wood from smelling when moisture gets to it for any considerable length of time. You may reduce this trouble, and I have no doubt the processes mentioned do reduce it. But even with the cells of the wood filled there is still the fibre itself which, when rained upon, the capillary attraction will draw the moisture into the wood. The cell is a little mesh of fibers, and there are little interstices between the cells which, to a certain extent, will draw the moisture. After three or four years there will be a slight swelling in the wood. When first laid you will have no trouble with it. They have no trouble with their pavements swelling in Europe. They have over a million yards of it in London, and they have no trouble with the swelling of the blocks. Over there they keep the pavements sprinkled daily. Wherever that is done they have no trouble. Besides that there are two-inch expansion joints put in each side.

MR. ADÁM: That is only for a transverse section of the block, is it not?

MR. KENYON: Yes. The blocks here are laid at an angle. The block has two expansions,one the radial expansion and the other the tangental expansion. The radial expansion is less than the tangental expansion. If the blocks are laid at an angle across the street the expansion is taken up by more than one expansion joint. If you lay them at an angle of 27 degrees it takes up the expansion.

MR. TILLSON: I was a little worried when I heard about the expansion Mr. Kummer spoke of in his paper on Union Street, Brooklyn. I was out of town when that happened. I found the expansion, while not as bad as reported, was so bad it broke the cement curb on both sides of the street. After the pavement had been taken up and relaid it expanded again. That was small block, and the only explanation I can make of it is that the blocks were not well treated. We have a block of this material laid last year, and we have not had the least trouble from expansion. After I heard of this I had a block taken from one of the streets they were working on. I took this block to the laboratory and immersed it in water. It absorbed some water, about one-third per cent., in six weeks, but it has not expanded one particle so far as we can tell by measurement. These blocks were treated with so much of the material that they would sink in water.

MR. POLLOCK: We have had no complaint of the Medina pavement. I have not noticed that there was any rumble such as we have with the brick pavements, and certainly the Medina pavements are not slippery.

MR. ADAM: I spoke of the slipperiness of the surface of a street where the cement was spread over the blocks. Where the cement grout was used the blocks got covered.

MR. TILLSON: The cement will never be smooth, because it will wear off soon, and the blocks themselves will not be slippery.

MR. ADAM: In Worcester the cement got on the blocks and made them more slippery than asphalt.

MR. SHERRERD: I think an amendment to the Constitution was submitted yesterday. Is it in order to bring it up now?

PRESIDENT RUST: We take it up after the discussion on pavements is completed.

MR. REIMER: I don't think we can ever build a road that will not wear out. I believe all the interest of this Society should be used towards securing legislation necessary, or action on the part of public bodies, that will help us keep the pavements as long as possible. I don't know whether you have anything in this part of Indiana that will make a man put a wide tire on a wagon that holds four tons; but I think if we can use influence that will bring something to bear upon those men to keep them from destroying roads we will do as much towards good road making as anything. If we can secure some legislation that will compel these men to use wide tires on their wagons it will be better for our asphalt, granite, brick or bithulitic pavements than anything else. This is a sort of hobby of mine.

PRESIDENT RUST: There are some new members to be elected. Is it your pleasure to pass upon the names that have been presented?

The Secretary read the folowing list of applicants for membership:

L. V. Christy	Wilmington, Del.
E. S. Rankine	Newark. N. J.
E. S. Barrow	Hamilton, Ont.
F. J. Phinney	Rockford, Ill.
Henry Bruggeman	Alton, Ill.
Fred J. Kerm	Belleville, Ill.
J. N. Hazelhurst	Mobile, Ala.
Alfred Clark	Concord, N. H.
A. D. Richey	Elwood, Ind.
Harry H. Devereux	Springfield, Ill.
Frank H. Hamilton	Springfield, Ill.
M. W. Murphy	Burlington, Iowa.
T. Chalkey Hatton	Wilmington, Del.
W. H. V. Reimer	East Orange, N. J.
Arthur A. Adler	Chicago, Ill.

MR. TILLSON: A number have registered who have neither paid dues or said anything about becoming members, and those I have not placed in the list just read. The names read are names of those who have registered and paid their dues, or who have asked me to present their names.

On motion of Mr. Benzenberg the rules were suspended and the applicants whose names were read were elected to membership.

SECRETARY TILLSON: The following amendment is the one I presented on Tuesday: "To insert in the third line of Article IV, Section 1, before the word 'past' the words 'three last.'"

PRESIDENT RUST: What is the pleasure of the Society in regard to this amendment?

Mr. Ballard: I move its adoption. I think it is a wise thing to do.

Mr. Sherrard: I should like to move an amendment.

I move to amend that the section read, instead of "the three last Past Presidents," "and who with the Past Presidents who have retained their continuous active membership."

We would in this way retain on the Executive Committee several Past Presidents who have continued their membership, and I think the Society will gain by the retention of such Past Presidents as Mr. Lewis and Mr. Benzenberg.

Secretary Tillson: I shall accept the amendment.

Mr. Sherrerd: I might speak of another thing. We have broken the rules laid down by the Constitution a number of times in the matter of electing more than one officer from the same state, and it would be quite as well to include in this same amendment the provision that only two of the officers shall be from the same state.

Secretary Tillson: I shall accept that amendment also.

The amendment to the Constitution, as amended, was then adopted as follows:

AMENDMENT.

Section 1. The officers of this Society shall consist of a President, three Vice Presidents, a Secretary and a Treasurer, not more than two of whom shall be a resident of a different state and who, with the Past President, who shall have retained their continuous active membership, shall act as an Executive Committee for and in behalf of the Society.

Mr. Folwell, of the Committee on Written Discussions of Papers, submitted the following resolution, which was adopted:

Resolved, that written discussion of the papers read at each annual meeting will be received in duplicate by the Secretary within two weeks of the adjournment of such meeting, and one copy shall be submitted to the authors of the papers discussed, to permit them to reply thereto. But the Secretary shall reject or return for revision or condensation any discussion or parts thereof when in his judgment this is desirable.

Mr. Ballard: Considerable has been said in regard to increasing the membership of this organization, and I want to make a suggestion that may have a tendency to increase the membership. I belong to a certain organization where, in order to increase the membership at various times, the presiding officer will suggest to every member present that he agree to bring in one member up to a certain time. This has worked very well. I think if all the members at this time will take enough interest to agree to bring in one new member we will have a large increase over the present membership. Often a member in one city will be acquainted with a gentleman in another city who is interested in this work, and if he will only take the trouble he may induce him to become a member. It can certainly do no harm to make an effort to do this, and it may do a great deal of good. I simply make this as a suggestion. Mr. Benzenberg said this morning he hoped there would be a great deal of activity on the part of the officers elected by this organization for the coming year in the matter of increasing the membership. I think the Secretary and myself may be able to formulate something in the shape of a circular to send out to members as well as those who are not members, urging members to present the letter to their friends in different municipalities and induce them to join the Society.

President Rust: I think your suggestion a very valuable one.

Mr. Sherrerd: I should like to offer a resolution, as follows:

Resolved, that the American Society of Municipal Improvements in Convention at Indianapolis, Ind., appreciate the courtesy extended and the generous actions on the part of the Commercial Club, the Local Committee, the Indianapolis Traction & Terminal Company, the Indianapolis Water Company and the citizens of Indianapolis; to make our meeting in this city a memorable success and that the thanks of the Society are hereby tendered to them for their generous hospitality and that the Secretary be directed to transmit the thanks of the Society to these several organizations.

The resolution was seconded, and carried by unanimous vote.

Mr. Benzenberg: I should like to suggest that the incoming officers, or those who have the fixing of the time of the next convention, correspond with the officers of the Municipal League and ascertain if it is possible to have a meeting at St. Louis the same week, and if so, to fix such date according to the Constitution.

MR. BROWN, Indianapolis: I would like to again suggest that we shall be very glad to help any of you to see any of the extra sights you have not seen. Mr. Eldridge is here and says he will be glad to show you any of the sights you have not yet seen, the steam heating plant and other interesting things.

On motion of Mr. Ballard the convention was then adjourned to meet in St. Louis in 1904.

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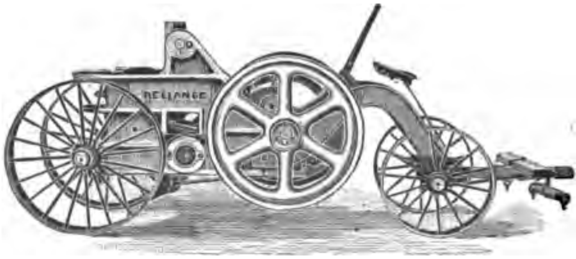

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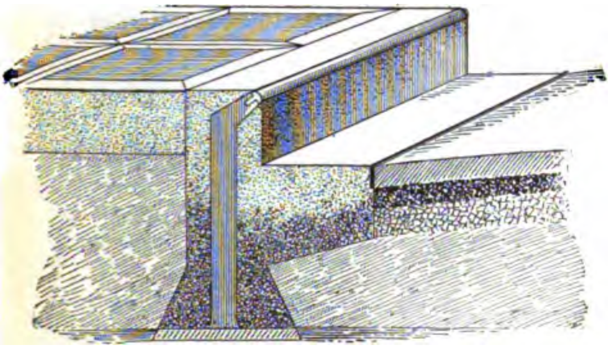

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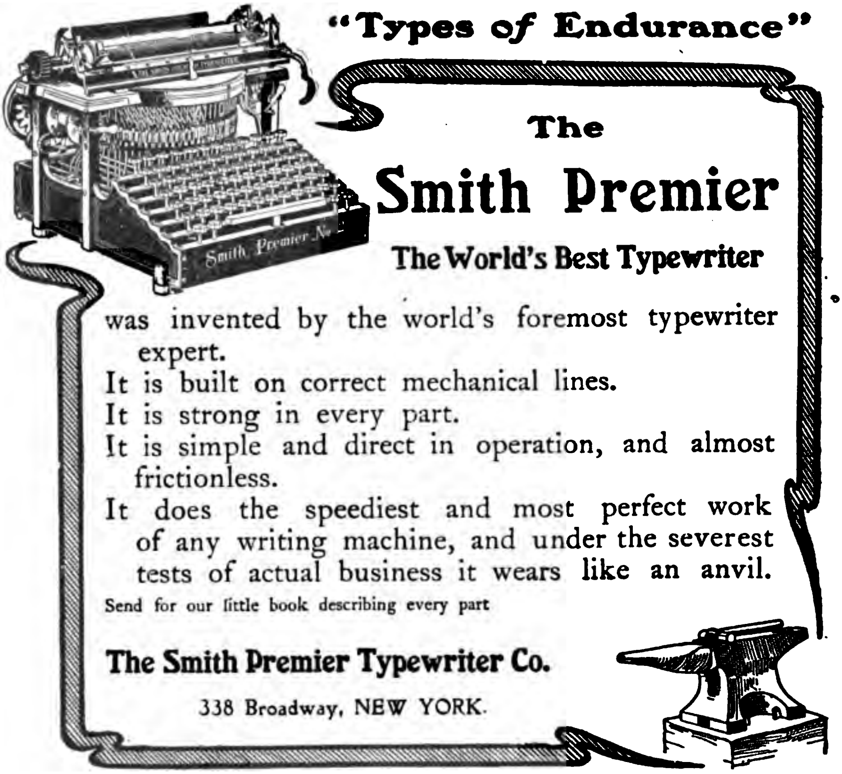

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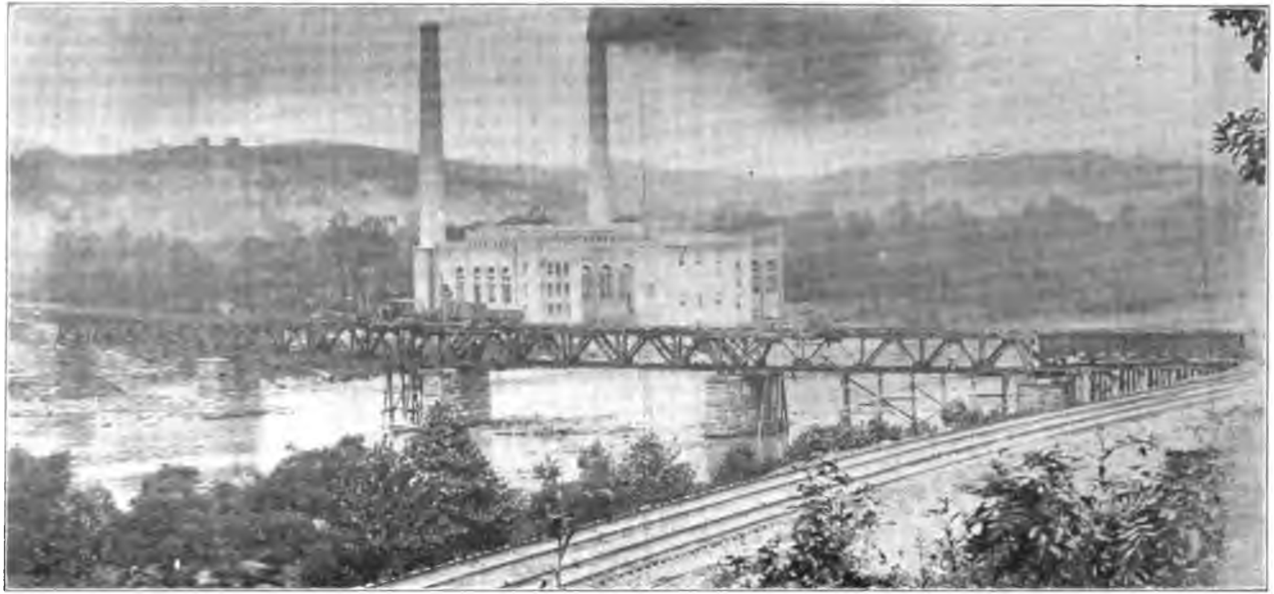

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ELEVENTH ANNUAL CONVENTION

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

Held at

ST. LOUIS, MISSOURI

October 4th, 5th and 6th,
1904

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PROCEEDINGS

OF THE

ELEVENTH ANNUAL CONVENTION

OF THE

American Society

OF

Municipal Improvements

HELD AT

ST. LOUIS, MO., OCT. 4th, 5th and 6th,

1904

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THE NEXT MEETING WILL BE HELD AT MONTREAL, CANADA, SEPT. 5th, 6th and 7th, 1905.

American Society of Municipal Improvements.

OFFICERS

1904-1905

President	A. PRESCOTT FOLWELL	Easton, Pa.
First Vice-President	C. C. BROWN	Indianapolis, Ind.
Second Vice-President	JOHN R. BARLOW	Montreal, Canada.
Third Vice-President	W. B. HOWE	Concord, N. H.
Secretary	GEO. W. TILLSON	Brooklyn, N. Y.
Treasurer	F. J. O'BRIEN	Oswego, N. Y.

FINANCE COMMITTEE

ALCIDE CHAUSSE, Chairman	Montreal, Canada.
E. S. BARROW	Hamilton, Ont.
A. F. EGGERS	Newark, N. J.

EXECUTIVE COMMITTEE

The officers of this Society, together with the Past Presidents who have retained their continuous membership, constitute the Executive Committee. The Past Presidents are as follows:

PAST PRESIDENTS

M. J. MURPHY	St. Louis, Mo.
GEO. H. BENZENBERG	Milwaukee, Wis.
AUG. HERRMANN	Cincinnati, Ohio.
HARRISON VAN DUYNE	Newark, N. J.
NELSON P. LEWIS	Brooklyn, N. Y.
A. D. THOMPSON	Peoria, Ill.
ROBERT E. McMATH	St. Louis, Mo.
E. A. FISHER	Rochester, N. Y.
C. H. RUST	Toronto, Canada.
GEO. M. BALLARD	Newark, N. J.

Standing Committees

Appointed by the President in accordance with Article IV, Section 4, of the Constitution of the Society.

1904-1905

STREET PAVING

C. D. POLLOCK, Chairman	Brooklyn, N. Y.
FRED GIDDINGS	Atchison, Kansas.
WALTER F. REICHARDT	Little Rock, Ark.

ELECTRIC STREET LIGHTING

E. A. FISHER, Chairman	Rochester, N. Y.
B. T. FENDALL	Baltimore, Md.
F. A. SNYDER	Summit, N. J.

SEWERAGE AND SANITATION

E. S. RANKINE, Chairman	Newark, N. J.
J. N. HAZELHURST	Mobile, Ala.
EDWARD J. JOHNSON	Nashua, N. H.

WATERWORKS AND WATER SUPPLY

D. W. MEAD, Chairman	Chicago, Ill.
A. J. PROVOST, JR	Brooklyn, N. Y.
E. S. BARROW	Hamilton, Ont.

TAXATION AND ASSESSMENT

N. P. LEWIS	New York, N. Y.
AUGUST HERRMANN	Cincinnati, O.
F. H. WOODS	Toronto, Ont.

CITY GOVERNMENT AND LEGISLATION

WM. S. CRANDALL, Chairman	New York, N. Y.
JULIAN KENDRICK	Birmingham, Ala.
THOS. NEVILLE	Rochester, N. Y.

DISPOSITION OF GARBAGE AND STREET CLEANING

B. E. BRIGGS, Chairman	Erie, Pa.
L. W. ANDERSON	Grand Rapids, Mich.
L. MARKBREIT	Cincinnati, O.

MUNICIPAL FRANCHISES

JAMES OWEN, Chairman	Newark, N. J.
CHAS. H. RUST	Toronto, Ont.
JOHN R. BARLOW	Montreal, Canada.

REVIEW

C. C. BROWN, Chairman	Indianapolis, Ind.
N. I. KER	Ottawa, Canada.
T. CHALKLEY HATTON	Wilmington, Del.

Special Committees

Appointed by the President in accordance with resolutions adopted by the Society.

MUNICIPAL DATA AND STATISTICS

WM. FORTUNE, Chairman	Indianapolis, Ind.
H. N. RUTTAN	Winnipeg, Manitoba.
H. W. WILMOT	New York, N. Y.

PARK DEVELOPMENT AND MAINTENANCE

G. A. PARKER, Chairman (Supt. Keney Park)	Hartford, Conn.
A. D. RICHEY	Elwood, Ind.
J. N. McCLINTOCK	Boston, Mass.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III—FEES AND DUES.

Section 1. Each municipality desiring to become a member of this Society may do so by the payment of five dollars admission fee, which will entitle said municipality to as many members to said Society representing boards or departments of said municipality as may be desired without any additional admission fee, but upon payment of the dues hereinafter prescribed

Sec. 2. Municipalities shall not be required to pay any dues; but each individual representing any department of the municipality that has acquired a membership in the Society, or any associate member, shall pay five dollars per annum as dues, the same to be payable on or before the date of the annual meeting.

Sec. 3. Any person not connected in any official manner with any municipality, or any person applying for associate membership, shall, upon election, pay an admission fee of five dollars and the annual dues hereinafter prescribed.

ARTICLE IV—OFFICERS.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of the same state, and who with the Past Presidents who have retained their continuous membership shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be apponited annually the following standing committees:

1. Street-Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any liabilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI—Duties.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Soociety not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII—MEETINGS.

Section 1. The annual meeting of the Society shall be held on the second Wednesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII—ORDER OF BUSINESS.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Report of special committees.
9. Reading and discussion of papers.
10. Election of officers.
11. Selection next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX—AMENDMENTS.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vote of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the 1st day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain, from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

LIST OF CITIES HAVING A MEMBERSHIP IN THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS

Albany, N. Y.
Allegheny, Pa.
Alton, Ill.
Archangel, Russia.
Atchison, Kan.
Baltimore, Md.
Belleville, Ill.
Birmingham, Ala.
Bloomington, Ill.
Boston, Mass.
Brooklyn (B'gh) N. Y.
Burlington, Ia.
Calgary, Can.
Champaign, Ill.
Chicago, Ill.
Cincinnati, O.
Cleveland, O.
Columbus, O.
Concord, N. H
Covington, Ky.
Davenport, Ia.
Easton, Pa.
East Orange, N. J.
Economy, Pa.
Elmira, N. Y.
Elwood, Ind.
Erie, Pa.
Grand Rapids, Mich.
Hamilton, Can.
Hartford, Conn.
Indianapolis, Ind.
Little Rock, Ark.
Milwaukee, Wis.
Minneapolis, Minn.
Mobile, Ala.
Montreal, Can.
Nashua, N. H.
Newark, N. J.
New York, N. Y.
Oswego, N. Y.
Ottawa, Can.
Parkersburg, W. Va.
Peoria, Ill.
Philadelphia, Pa.
Quincy, Ill.
Richmond, Ind.
Rochester, N. Y.
Rockford, Ill.
Sheboygan, Wis.
Springfield, Ill.
St. Johns, N. F.
St. Louis, Mo.
Toronto, Ont.
Urbana, Ill.
Wilmington, Del.
Winnipeg, Man.

LIST OF MEMBERS

Adler, Arthur A., 804 Chamber of Commerce, Chicago, Ill.
Adam, Ernst, Engineer Street and Sewer Department, Newark, N. J.
Alvord, John W., Consulting Engineer, 127 Hartford Bldg., Chicago, Ill.
Anderson, L. W., City Engineer, Grand Rapids, Mich.
Andrews, Horace, 125 Lancaster St., Albany, N. Y.

Ballard, Geo. M., Chairman Water Committee, Newark, N. J.
Barlow, John R., City Engineer, Montreal, Canada.
Barr, J. Carroll, Economy, Pa.
Barrow, E. S., City Engineer, Hamilton, Ont.
Bauman, C. V., Street Committee, Newark, N. J.
Benzenberg, Geo. H., Consulting Engineer, 436 Jefferson St., Milwaukee, Wis.
Boley, C. U., Engineer, Sheboygan, Wis.
Briggs, B. E., City Engineer, Erie, Pa.
Brown, Charles C., Editor Municipal Engineering, Indianapolis, Ind.
Bruggeman,, Henry, Mayor, Alton, Ill.

Cappelen, F. W., 702 Oneida Block, Minneapolis, Minn.
Chairman of Municipal Council, St. Johns, Newfoundland.
Chausse, Alcide, Building Inspector, Montreal, Can.
Christy, L. V., Secretary Street and Sewer Dept., Wilmington, Del.
Clark, Alfred, Commissioner of Highways, Concord, N. H.
Cochrane, L. Y., Superintendent of Highways, Allegheny, Pa.
Conkling, Leo D., City Engineer, Elmira, N. Y.
Crandall, Wm. S., Editor Municipal Journal, and Engineer, New York City.
Crane, James, Board of Control, Toronto, Can.

Devereux, Harry H., Mayor, Springfield, Ill.

Easby, Wm. Jr., Asst. Professor of Civil Engineering, College Hall, University of Pennsylvania, Phildelphia, Pa.
Eggers, Augustus F., Board of Works, Newark, N. J.

Fendall, Benj. T., City Engineer, Baltimore, Md.
Fisher, E. A., City Engineer, Rochester, N. Y.
Folwell, A. Prescott, Consulting Engineer, Easton, Pa.
Fortune, Wm., Publisher Municipal Engineering, Indianapolis, Ind.
Freiberg, M. J., Waterworks Commission, 216 E. Front St., Cincinnati, O.
Fulton, D. L., Director of Public Works, Allegheny, Pa.

Garrison, W. C., Board of Public Works, Newark, N. J.
Giddings, Fred, City Engineer, Atchison, Kan.
Glore, W. H., Superintendent Waterworks, Covington, Ky.
Goodell, John M., Editor Engineering Record, 114 Liberty St., New York.
Greathead, Wm. E., Clerk Board of Public Works, Newark, N. J.
Griggs, Julian, Engineer, Dept. of Public Works, Columbus, O.

Hamilton, Frank H., City Engineer, Springfield, Ill.
Hatton, T. Chalkley, City Engineer Street and Sewer Dept., Wilmington, Del.
Hazelhurst, J. N., Mobile, Ala.
Herrmann, August, President Waterworks Commissioners, Cincinnati, O.
Holloway, C. M., Waterworks Commissioner, Cincinnati, O.
Howard, J. W., Consulting Engineer, No. 1 Broadway, New York, N. Y.
Howe, W. B., City Engineer, Concord, N. H.

Johnson, Edward J., City Engineer, Nashua, N. H.
Jones, John, Superintendent of Streets, Toronto, Ont.
Judson, William Pierson, Deputy State Engineer, Albany, N. Y.

Kendrick, Julian, City Engineer, Birmingham, Ala.
Ker, N. I., City Engineer, Ottawa, Can.
Kern, Fred J., Mayor, Belleville, Ill.
Kiefer, Edgar S., Board of Public Works, Grand Rapids, Mich.
Kummer, F. J., General Manager U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Langenheim, G. C., City Engineer, Allegheny, Pa.
Leisen, Theo. A., Wilmington, Del.
Lewis, N. P., Chief Engineer Board of Estimate and Apportionment, New York City.
Logsden, Edwin D., Board of Public Works, Indianapolis, Ind.

McCartin, J. M., Street Commissioner, Birmingham, Ala.
McClintock, John N., Consulting Engineer, 45 Milk St., Boston, Mass.
McClintock, J. Y., Commissioner of Public Works, Rochester, N. Y.
McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.
McMillan, Chas., City Clerk, Calgary, Canada.
Magley, Wm., Board of Public Service, Cincinnati, O.
Markbreit, L., Waterworks Commission, Cincinnati, O.
Martin, Wisner, Asst. Engineer Bureau of Highways, Borough of Manhattan, N. Y.
Mead, D. W., 605 First National Bank Bldg., Chicago, Ill.
Mundy, J. Crowell, General Superintendent of Works, Newark, N. J.

Neville, Thos., Deputy Commissioner of Public Works, Rochester, N. Y.

O'Brien, F. J., Street Commissioner, Oswego, N. Y.
Owen, Jas., Consulting Engineer, 196 Market St., Newark, N. J.

Parker, G. A., Superintendent Keney Park, Hartford, Conn.
Phillips, Geo., Board of Public Works, Newark, N. J.
Phinney, F. J., Superintendent Water Works, Rockford, Ill.
Pierce, Geo. M., New England Bldg., Cleveland, O.
Pollock, Clarence D., Assistant Engineer Bureau of Highways, Brooklyn, N. Y.
Provost, A. J. Jr., Engineer to Borough President, Brooklyn, N. Y.
Putmann, J. E., Consulting Electrical Engineer, Rochester, N. Y.

Radenhaurst, Wm. N., care City Engineer, Rochester, N. Y.
Rankine, E. S., Engineer Sewer Department, Newark, N. J.
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.
Reichardt, Walter F., Assistant City Engineer, Little Rock, Ark.
Reimer, W. H. V., City Engineer, East Orange, N. J.
Richey, A. D., City Engineer, Elwood, Ind.
Rommel, Geo. Jr., Engineer Street and Sewer Dept., Wilmington, Del.
Rowson, John W., Board of Public Works, Grand Rapids, Mich.
Rust, Chas. H., City Engineer, Toronto, Ont.
Ruttan, H. N., City Engineer, Winnipeg, Manitoba.

Sherrerd, M. R., Superintendent Waterworks, Newark, N. J.
Skinner, John F., Waterworks Assistant, Rochester, N. Y.
Snyder, Frederick A., care Essex Union Water & Light Co., Summit, N. J.
Steece, Emmet, City Engineer, Burlington, Ia.
Stewart, Wm. J., First Assistant City Engineer, Rochester, N. Y.
Stobaeus, J. B., Member Board of Trade, Newark, N. J.
Strain, Jas. H., Manager Oastler Road Roller, 254 E. Twenty-first St., Brooklyn, N. Y.

Taubenheim, Ulrich E., Manager City Waterworks, Archangel, Russia.
Thompson, A. D., 304 Masonic Temple, Peoria, Ill.
Thompson, S. C., Prin. Asst. Engineer Bureau of Highways, Borough of Bronx, New York.
Tillson, Geo. W., Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Talbot, A. N., Professor of Civil Engineering, University of Illinois, Urbana, Ill.

Vinson, J. S., Board of Public Works, Newark, N. J.

Weil, Samuel, Jr., Board of Public Service, Cincinnati, O.
Wilmot, H. W., Expert Accountant, 54 William St., New York City.
Woods, F. H., Chairman Commission on Works, Toronto, Ont.

A. PRESCOTT FOLWELL
Consulting Engineer, Easton, Pa.
President, American Society of Municipal Improvements

PROCEEDINGS

OF THE

ELEVENTH ANNUAL CONVENTION

OF THE

American Society of Municipal Improvements

HELD AT

ST. LOUIS, MO., OCT. 3, 4 AND 5, 1904

The first session of the Convention was called to order at 2 o'clock P. M., Tuesday, October 3d, in the Auditorium of the Grand View Hotel.

President George M. Ballard in the chair.

PRESIDENT BALLARD: The first business in order will be the calling of the roll.

On motion, the calling of the roll was dispensed with.

PRESIDENT BALLARD: The next thing in order is the reading of the minutes of the last meeting.

SECRETARY TILLSON: As the minutes of the last meeting have been printed and each member furnished with a copy, I move that the reading of the minutes be dispensed with.

The motion was seconded and carried.

PRESIDENT BALLARD: The next thing in order is the consideration of applications for membership.

SECRETARY TILLSON: The following applications for membership have been presented:

J. M. Goodell, Editor *Engineering Record,* New York City.
James Owen, County Engineer, Essex County, Newark, N. J.

George H. Phillips, Commissioner Board of Works, Newark, N. J.

A. J. Provost, Jr., Engineer to Borough President, Borough of Brooklyn, New York City.

Julian Griggs, Engineer Board of Public Works, Columbus, O.

H. N. Ruttan, City Engineer, Winnipeg, Manitoba.

William Easby, Jr., Municipal Engineer, Media, Pa.

J. Carroll Barr, Economy, Pa.

Wisner Martin, Assistant Engineer, Bureau of Highways, Borough of Manhattan, New York City.

S. C. Thompson, Principal Assistant Engineer, Bureau of Highways, Borough of Bronx, New York City.

Walter F. Reichart, Assistant Engineer, Little Rock, Ark.

H. W. Wilmot, Expert Accountant, 54 Williams Street, New York City.

George Rommell, Jr., Engineer Street and Sewer Department, Wilmington, Delaware.

B. T. Fendall, City Engineer, Baltimore, Maryland.

It was moved that the Secretary be directed to cast the ballot of the Society for the candidates whose names were read by Secretary Tillson.

The motion was seconded and carried, and the President announced that the gentlemen had been duly elected to membership in the Society.

PRESIDENT BALLARD: It has been our custom usually to hold off and wait, sometimes for an hour at a time, for persons to come in and form a quorum to enable us to begin our proceedings. The meeting this afternoon was called for 2 o'clock sharp. If it is the wish of the members to have the President's address now I shall proceed with it.

I want to say one other thing, and that is in regard to the papers that are to be read. The papers will be called for in their regular order, and if the author of the paper is not here at that time the business will go on and the papers will have to go to the foot of the list.

I think that is only fair to those who are present when their papers are called for. I hope each one in his turn will be on hand and ready to respond.

Members of American Society of Municipal Improvements:

LADIES AND GENTLEMEN: This is the Eleventh Annual Convention of our Organization; preceded by ten years of steady work; having in view at all times measures calculated to benefit the several municipalities we represent. I appreciate the honor conferred in selecting me to preside over your deliberations, and will endeavor to do so, impartially and intelligently. As far as I understand the object of our Association, it is to present matters on all subjects, that will have a tendency to improve the conditions as they now exist, in all municipalities now represented by us, or in which we may be interested. Some of us are office holders, and I presume those that are not, hope to be in the near future, but be that as it may, I feel convinced that every one of us is endeavoring to elevate, improve and advance present conditions, in so far as to insure the greatest good to the greatest number.

I desire to impress upon your minds the importance of increasing your membership. The success of this Society depends very materially upon a large and growing membership, and I suggest to you, one and all, both absent and present, that you use every means within your power, with every official acquaintance in any locality, to become members of the American Society of Municipal Improvements.

It has been suggested to me several times during the present year that we hold joint sessions with other organizations somewhat similar to ours, but after consultation with other of our officers, it was not thought to be feasible at the present time, perhaps future developments may have a tendency to show that much good can be gained by such joint meetings, and prove to be of great and lasting benefit to all parties interested therein.

Municipal Improvements. A few words now as to municipal improvements that help to make cities great. I assume that pure water, a complete sewerage system, well paved, smooth, clean, noiseless streets, thoroughly lighted by electricity, a perfect system of garbage collection, and a well appointed electric system for travel, are the principal improvements that tend to make a city great. I can not enlighten you as to the engineering or mechanical construction necessary to make these several named improvements perfect in detail, but I have reason to believe that after you have heard the papers read, that will be presented to this Convention, that the suggestions contained herein, will have a tendency to make clear to your minds many things that may at this time appear to be somewhat clouded or undefined, and all such information will be debated by you, and taken to your several homes and there dissected and enlarged upon, and at our next annual meeting many new and valuable suggestions will be presented, and many things made public that will prove to be of great and lasting benefit to all parties in interest.

Street Paving. This subject is attracting as much, if not more attention at this time, than any other city improvement, and the inquiry and demand is for a substantial, smooth, clean and noiseless pavement.

A pavement embodying these qualities is sure to be a public benefactor in great demand. Granite or stone block is objected to because of the noise and rough surface; asphalt because of its slippery surface and unenduring qualities; macadam because of its inability to stand the heavy wear and tear; brick because of its uneven quality, by reason of the uncertainties connected with the making of the same; treated wood block because of its being too expensive, and in the minds of some persons not durable, and slippery.

The genius that succeeds in producing a street pavement that is smooth, clean, noiseless, easily traveled and lasting and not too expensive, will receive the everlasting thanks of mankind in general, and a well filled purse that will last him and his posterity for generations yet to come.

In Brief. Concluding, I tender my thanks to the officers and chairmen of the various committees, as well as to the members who have so kindly prepared papers to be read at this meeting, for their efforts to make this gathering a success, and I express the hope that when we have completed our tasks, we will take to our homes pleasant recollections of time and money well spent in our efforts to improve our surroundings, and in our endeavors to make the burdens of life less onerous and oppressive to ourselves and to our several constituencies.

GEO. M. BALLARD,
President.

The Secretary then read the following report:

REPORT OF THE SECRETARY.

BROOKLYN, N. Y., Oct. 1, 1904.

American Society of Municipal Improvements:

GENTLEMEN: I herewith submit my report for the years 1903 and 1904:

Receipts—	
Cash on hand October 30, 1903	$5.00
Dues	390.25
Sale of reports	64.50
Total	$459.75

Amounts paid to Treasurer—	
October 25, 1903	$255.00
March 3, 1904	143.25
April 18, 1904	16.00
August 11, 1904	21.50
September 28, 1904	24.00
Total	$459.75

The expenses of the office for the year have been as follows:

Postage	$7.52
Stationery, printing, etc.	10.00
Express	2.60
Badges	12.00
Receipt books	8.75
Total	$40.87

On account of the arrangements authorized by the Board of Directors, the report of the last meeting was issued without any expense to the Society.

During the year there has been a good demand for the Society reports, as is shown by the sales. The value of the publication has been generally recognized, as many of the sales have come from libraries and professional men.

The correspondence of the Society has been attended to, and ledger accounts kept with individual members.

Two postal card notices have been sent to each member calling attention to this meeting, one about two months and the other two weeks in advance of the meeting.

The Secretary wishes to thank all the officers of the Society for their hearty co-operation throughout the year.

GEO. W. TILLSON,
Secretary.

Approved and found correct.

ALCIDE CHAUSSE,
A. F. EGGERS.

On motion, the Secretary's report was received and made a part of the minutes of the meeting.

PRESIDENT BALLARD: Is there anything to come up under the head of new or miscellaneous business? If not, we will proceed with the next order of business, which is the hearing of reports and the reading of papers. The first thing to be heard is the report of the Committee on Municipal Data, of which William Fortune, of Indianapolis, is the chairman. As Mr. Fortune has not arrived that report will be deferred. There are no members of the Committee on Municipal Franchises or the Committee on Taxation and Assessment present, so those reports will also be passed over for the present. Mr. Walter F. Reichardt, of Little Rock, Arkansas, is present and will read a paper on "The Sewerage System of Little Rock, Arkansas."

THE SEWERAGE SYSTEM OF LITTLE ROCK.

BY WALTER F. REICHARDT, ASST. CITY ENGINEER, LITTLE ROCK, ARK.

In April, 1881, a number of public-spirited citizens of Little Rock, Ark., held a meeting in the city hall of that city for the purpose of devising means for the construction of sewers. At this meeting a petition was drawn asking the city council to take the necessary steps towards the making of local improvements in the way of sewers, under the provisions of an act of the General Assembly, entitled an "act to regulate the manner of assessing the real property for local improvements in the cities of the first and second class," approved March 22, 1881.

And it was at the following meeting of the council that a district was formed and designated as Sewer District No. 1.

All improvements in the city of Little Rock are made by improvement districts, which are formed as follows:

When ten or more owners of real property in the city and in the territory therein after designated, petition the council to form a district, and if said petition is granted, the district is formed.

After the district has been formed the petitioners present to the council the names of three owners of real property in said district, to act as a Board of Commissioners, and if such names are satisfactory to the council, these three men are elected commissioners and thereafter have entire control of said district.

All contracts are let by the commissioners and all work is done under the supervision of their engineer and is accepted by them, and they have complete control of the improvement until turned over to the city. When all assessments have been paid and the district is free from debt the district is turned over to the city which takes charge of same and keeps it in repair.

In the selection of commissioners for sewer districts, as well as other improvement districts, the most competent men to serve are not always chosen, and sometimes men who are not at all familiar with the improvement are selected, and of course it is natural that the district does not get all that it might have gotten if other commissioners had been selected. It is therefore that the writer believes that some of the commissioners of the sewer districts are to blame for the present condition of the sewerage system as well as that class of men known as "engineers."

In the same manner engineers are engaged by the commissioners, not perhaps due to the fact that they are the most competent in the city, but because of their influence with the commissioners. As a general rule the engineers were paid but little salaries, and the engineers could not give much time or attention to the work. It was not how competent is the engineer, but how cheap will he work; but in the last districts the city engineer has been employed, and as a result, better work has been received and the future interests of the city looked after. It is the opinion of the writer that if more care would be taken in the selection of commissioners better work would be received in all improvements throughout the city, and believes the council should give this matter more attention.

In a number of instances the commissioners intended doing their best, but on account of the lack of knowledge of the improvement, did not get the results that they would have gotten had they been better acquainted with the subject.

Sewer District No. 1 was constructed in the business center of the city and was built of 21-inch vitrified clay pipe. At the time of the construction of this sewer. the pipe was large enough for the district it drained, but the commissioners failed to realize that this district would serve as an outlet for the greater part of the sewers of Little Rock.

According to the United States census of 1880, Little Rock then contained a population of about 13,000; the estimated population at the present time is 50,000.

Little Rock has a total area of 11.45 square miles and the total length of sewers is twenty-eight miles with two miles under construction. On account of its high elevation above the river and topographical situation, Little Rock is well adapted for an excellent sewerage system. There is but a small part of the city that would be without sewerage today had the present sewers been built with the view of draining the whole city.

Reliable information has been received that Sewer District No. 1 was constructed entirely without regard to any other part of the city, and instead of using a minimum grade a maximum one was used.

Perhaps it was the cost of the sewer that caused the commissioners to construct the sewer in such a manner, but had they considered the cost of reconstructing the sewer in twenty-five years they would have taken a different view of the matter.

District No. 1 was not the only district that was built without regard to the future growth of the city, but district after district was so consructed, until a few years ago the people realized that they were not constructing sewers that would meet the demands of a large city.

As an example to the crowded condition of these districts, I call attention to District No. 7, which is in the business center of the city, and was constructed of 10 and 12-inch pipe. District after district has been built and connected to this sewer until at the present time about fifteen miles of sewers empty into No. 7.

The grade and the size of the sewers are not the only reasons for reconstruction, but the manner in which they were constructed, and that you may have an idea of the manner in which the sewers were constructed, I will give in detail a few methods of construction used by the engineers and contractors in charge.

The sewers are constructed of vitrified clay pipe, the size of which varies from six to twenty-one inches, the greater part, however, being 8 and 10 inches in diameter.

In the business section of the city some 21-inch mains are in use, but these extend for only a few blocks in length. As each sewer was built by a separate district, which engaged their own engineer, the mode of construction has more or less differed in all of them, and for that reason Little Rock has a peculiar sewerage system.

The soil of Little Rock is for the most part red clay and gravel, and is very easily handled, and gives the pipe an excellent foundation. In but exceptional cases sheeting has been used, and sewers have been constructed with a cut of 22 feet without the least bit of caving. With a soil that affords such a solid foundation and dry ditch it seems hardly possible that anything but a good sewer could be constructed with an ordinary amount of care, but some have been constructed in this city that would not be a credit to a village, no matter how small.

It has been the case that when contractors came in contact with soft ground or when water had gotten into the ditch but little more care was used in laying the pipe then than if they were working on a solid foundation. When such soil has been met it has not been the custom of the majority of the engineers to remove the soft material and replace it with dry earth but, on the contrary, would place a few rocks under the bell of the pipe. The rocks would keep the pipes at grade temporarily, and to the passing inspector would appear as though the pipes were on a solid foundation, and the result of such work was that when the backfilling was begun, the pipes were disturbed by the falling earth and rocks.

In some cases scrapers are used for backfilling, and one can imagine how easily a pipe could be knocked out of grade, and the joints broken, when the contents of a scraper is dumped upon the pipe. Before using the scraper for backfilling the pipe is covered with six or eight inches of dirt, just enough to prevent the falling rock breaking the pipe. When a sewer that has been constructed in such a manner fails to carry off the sewerage as designed, the people say that the engineer gave a poor grade, while in truth the grade was given correctly but the contractor did not conform to the grade given. A short time ago some pipe of one of the sewers constructed but a short time, was taken up and on examination was found to be half full of sludge, which was due to the poor construction of the sewer. This sewer had not been in use more than three years and no more than thirty houses had been connected to same.

In some of the sewers constructed a number of years ago the joints were made, first by caulking them with oakum, and then having the man caulking the joints, by using rubber gloves, press the cement into the joints after the oakum had been caulked in. This, however, was considered by some of the engineers of the later district to be a waste of money and time, and therefore they ceased using oakum and caulked the joints with cement only, using rubber gloves. Neat cement was used and with that method the engineer thought he was getting a tight joint. In mixing the neat cement the specifications were not always followed, for on a sewer where the writer was inspector the contractor was using Louisville cement and street dust. Clean, sharp sand was called for in the specifications, and it was for that he was to be paid, but in order to make as much as possible he used dirt taken out of the street gutters, and he felt as though we were imposing on him because the work was stopped until the arrival of clean, sharp sand.

A number of the engineers and contractors of this city who had charge of the greater part of the construction of the sewers of Little Rock have been consulted and, without an exception, all stated that the sewers were constructed without the least regard to the subject of the "perviousness of the sewer," and as one stated very forcibly that he cared only to keep the sewerage in and not the water out. This was very plainly shown by another engineer who constructed a sewer in the bottom of the "town branch," which is the natural drainage for nearly all of the storm water of the city, and through which water is always flowing. The sewer was constructed with as little attention to the perviousness of the joints as if the sewer was being built in the high districts of the city where there is but little water even in the wet season, and the result of this poor construction was that during the first heavy rain 150 feet of the pipe of this sewer was washed into the river. After the loss of this pipe part of the sewer was reconstructed and was covered with concrete, and now appears to be giving better results. Another contractor who constructed part of the system said that he did not think it was of much importance whether or not the joints were made tight, for he contended the sewerage passing through the pipe would cement the joint. Others claim that if water in the ground would flow in, that of itself would keep the sewerage in, but they have never had the thought that water is not in the ground all the year round, and that during the dry season, which is of long duration in this climate, the sewerage would discharge into the ground, thereby polluting the ground water and causing all the evils recognized as resulting therefrom.

However had the joints been well made and the infiltration due simply to the porosity of the cement, there would have been little danger, if any, of polluting the ground water. Too much emphasis can not be laid on the desirability of making joints as tight as possible everywhere, and especially at the bottom, where the poorest jointing generally is found.

It appears that in the construction of some of the sewers of Little Rock the only object in view of those in charge was simply to lay the pipe so that it would meet the only requirement—the test—which consisted of passing a wooden ball through the sewer. If the ball passed through the sewer the work was considered O. K. and then accepted by the engineer and commissioners. In some cases other tests were made by some few engineers of this city, and on account of these extra tests have been called cranks by some of the contractors as well as other citizens.

Another error in the construction of this sewerage system was that the sewers were built without any provision for ventilation. The result is that at certain manholes the odor is so offensive that one is compelled to hurry by. At any time of the day this offensive sewer gas can be detected and the manhole is conspicuous by the green flies that swarm about same. The flush tanks are not provided by any overflow pipes, nor has any provision been made for testing the pipes from the tank. As a general statement all of the flush tanks are poorly constructed and are not water tight.

The manholes are constructed of brick, and are, as a general rule, fairly good. They are, for the most part, built with eight-inch walls, and are plastered on the outside. However, in a number of them the bottoms were built without any slope and consequently today they have three and four inches of sludge instead of being clean and affording an unobstructed outlet for the sewerage.

The backfilling of the ditches has caused the city a great deal of trouble and at the present time the city engineer and street commissioner are trying to arrange a way for better work on the part of the contractor. Heretofore when a contractor had finished backfilling the ditch it had the appearance of a small railroad embankment, and it was almost impossible to drive over. A number of the contractors tunneled in the construction of the sewers, whenever they were working in good soil and a cut of 13 to 16 feet. They claimed they could handle the dirt cheaper by tunneling after a depth of 13 feet was reached. However, some of our engineers objected to tunneling because they were of the opinion that a tunnel could not be properly backfilled, and that in course of time the tunnel would sink, thereby destroying the improvements made on the street. Yet with this objection a great deal of tunneling has been done in the construction of the Little Rock sewers. About four years ago a tunnel was made under one of the principal streets of the city, and today the street is showing the effects of that work, and will be in poor condition until fully settled. In the construction of District 29 the contractor says he tunneled one hundred feet under Broadway and adjoining property. The cut was 22 feet in red clay and gravel, and the tunnel was made large enough for a man to work in comfortably. There was not one piece of bracing in the whole tunnel and in no instance did it show any signs of caving, even though the ditch was flooded by a heavy rain. Besides the backfilling there is another objection to tunneling and that is the manner in which the pipes are laid in the tunnels. The pipes were laid in the following manner: At each end of the tunnel stakes were driven to grade and a cord connecting the stakes was tied at the grade point on the stakes, and the pipes were laid to the grade of the cord. It is a certain fact that there was slack in the cord and that the pipes were not laid to their proper grade. Besides this the engineer could not inspect the cementing of the joints as they should have been, and furthermore, the laborers could not do as good work in such a place as in an open ditch. As a general rule they worked in a very big hurry as they were anxious to get out of the tunnel, as they have not much confidence in the contractor's ability to judge good earth for tunneling. The contractors claim the engineer objects to tunneling because he does not care to get in the tunnel, but it is a known fact that none of the contractors of this city ever go into the tunnel and inspect their work, but stand upon the bank of the ditch, high and dry and send their laborers into the tunnel and let them take the risk. It is very foolish for an engineer to run such an unnecessary risk of having a poor sewer constructed when he is paying the contractor for an open ditch.

Taking the sewerage system as a whole, it appears that the engineers or contractors paid but little attention to its construction, and the result is that Little Rock has a poor sewerage system, and today that city is preparing to meet a great financial problem, which will come when these sewers will have to be reconstructed, and the writer believes that day is not far away. The need of a new system will show itself when the city compels all property owners in the sewer districts to make connections.

Under the present law all improvements have to be made by improvement districts, but at the last election a vote was taken on an amendment, which if passed, would allow the cities of the first and second class the right to issue bonds for public improvements. The fate of this bill is not yet known, but if carried, Little Rock will construct a system of sewers that will be a credit to any city and will provide for the future growth of the city.

Besides the size of the sewers and their construction, there is still another affair worthy of account, and that is how will the city provide for sewers in the extreme southern part of the city, which is too low to use the present sewerage system. The property in this section is very valuable and some method will have to be devised to take care of the sewerage of that district. A number of methods have been spoken of by different engineers and citizens, but the writer advocates the use of the septic tank system, and believes that system will give the best results. There is a stream, known as the Fourche, just south of the city, and this stream would serve as an outlet for the sewerage after pasing through the tanks.

Another method has been also spoken of favorably among some of the citizens, and that is, to make a canal out of Fourche, into which they intended draining the sewerage, but as the cost of this would be so great, I do not think it will ever be used.

The total cost of the present sewerage system is about $250,000, but if it were rebuilt the cost would not be so much and a better system would be constructed, as the city would profit by costly experience.

In presenting this brief paper, it has been the endeavor of the writer to give to the Society some idea of the size of the sewerage system of Little Rock, and the methods used in its construction. It is not the province of this paper to criticise, in an unfriendly manner, the sewerage system of Little Rock, nor is its intention to attack any one engineer or contractor of that city. But its purpose is to show to the Society just what kind of a sewerage system Little Rock has, and how it could have been bettered, and it is hoped that this paper will bring out some discussion by which that city can improve the present system, and furthermore, that some city contemplating the construction of a sewerage system will profit by the experience of Little Rock, Arkansas.

PRESIDENT BALLARD: This paper strengthens me in the belief that there are some contractors that are dishonest. If any of the members present desire to discuss this they can do so.

MR. SHERRERD: I think the American Society of Municipal Improvements ought not to allow that paper to go into the Proceedings without discussion. It brings out the very point the Society ought to be desirous of making to show the fallacy of attempting to do municipal work in a piecemeal fashion. I think we ought to at least back up our member in his statement that this method of procedure has been very expensive, to say the least, for Little Rock. Certainly all engineers will agree with me when I state that sewer work in particular ought to be done on a general system, and to attempt to divide it up into sewerage districts, as has been done, not only in Little Rock, but in all the cities in that state of the first and second class, is a very serious engineering mistake. There is certainly one thing that ought to be looked after in sewerage construction, and that is to embrace in a system that portion of a city that will naturally drain toward that district. As I understand it, any number of citizens in any district, provided they number ten, can ask for a sewerage system, without any reference to grade.

MR. FISHER: Do I understand that ten citizens can get a sewer put in that portion, even if no other portion of the city can use it?

MR. REICHARDT: They can. If ten citizens wish to have their homes drained, they can go to their alderman and get a sewer built without reference to the grade of the other sewers. Politics, of course, plays a part in this.

MR. BARROW: I consider that all engineering work, not only sewerage systems, but road work, waterworks, etc., should all be constructed on a comprehensive plan. I think there is sometimes a difficulty in knowing how much we should look forward in the matter.

Engineers in reporting to municipalities very often suggest the importance of having engineers make their plans before they start any of the work. It seems to me I never heard of an instance in which that policy was so entirely disregarded as in this case of Little Rock, according to the paper. It seems to me the publication of this paper and its distribution among our members, if read by the authorities of any city contemplating any improvement work of any character, would certainly be a better example than the argument of any engineer. If an engineer, in making a report of such a matter, would refer to this paper, it will be better than any argument he can use to show *how* extremely necessary it is for any city to have a comprehensive and complete plan before beginning. Then if they wish to carry out the plan in detail there is no particular objection to it.

There is one thing I do not quite understand. If, for instance, the people of one district have constructed their sewer and have paid for it, and another sewer is connected and empties into it, can the second district do that for nothing?

Mr. Reichardt: According to law they can not, but there have been cases where the first sewer was tapped at night. A small fee is charged for connecting a new sewer with another, but it all depends upon how much influence the commissioners have in politics. The districts are never constructed with the idea of taking any more in. The natural outlet of the sewers is the Arkansas river.

Mr. Rankin: Is there any uniformity in the size of the sewers?

Mr. Reichardt: No. If there are ten people in a district five miles long they can have a sewer. If there are ten people in two blocks they can have it. All the other people in the district are then assessed.

Mr. Adam: Speaking of making connections of one district with another. This does not apply in Newark. You speak of making connections without the consent of the people who were assessed for the first sewer. In Newark some years ago there was a peculiar condition. That was before the commissioners of the board of works had the right to construct sewers without petition. At one time one-half the number of feet frontage had a right to lay a private drain. That was done before things were better regulated. There were a great number of private sewers laid. Then other people wanted permission to connect with these private sewers. A law was then passed which provided that property owners who wanted to enter the private sewer should pay a pro rata share. When a man laid a pipe two hundred feet in length and a man beyond wanted an extension and he would have to extend it fifty feet to reach his house, he would have to pay the party who laid the two hundred feet a proportionate part of the cost of laying it. So it went on increasing, and caused a great deal of trouble and vexation. Finally the city council took the bull by the horns and decided that the man who extended the pipes was not compelled to pay anything in addition to his own extension; that he was not compelled to pay anything to the man who first laid the pipe, because it was laid in a public street.

Mr. Pollock: Mr. Reichardt spoke of the trenches being mounded up so high it was impossible for a team to pass over them. I was wondering how that could be with small pipe sewers. How could they have such a surplus of earth? Was there no tamping or backfilling?

Mr. Reichardt: Their idea was to see how quickly they could throw the dirt in and leave it. If the people made objections the contractors would get aggrieved and take it into the courts, and with the influence those contractors had the commissioners were glad to pay them. Now the council and the people are trying to devise some means of compelling the contractors to backfill properly.

Mr. Folwell: I should like to ask how it would be possible for one sewer to be surreptitiously discharged into another if they had plans?

Mr. Reichardt: The city proper has no plan. The commissioners have profiles. Instead of turning them over to the city

CHARLES C. BROWN
Editor Municipal Engineering, Indianapolis, Ind.
First Vice-President, American Society of Municipal Improvements

they retained them. I hate to discuss this because, as one of the citizens of the town said: "The best way to describe this is that we have made a terrible mess of it."

MR. FOLWELL: I was in San Francisco fifteen years ago, at a time when an engineer of sewers had just come into office. He was investigating, and said the way they had been doing there was to lay every sewer with a crown eleven feet below the level of the street. I asked if there was not a plan for the regulation of the size of sewers. He said when a certain district asked for a sewer the tax list was investigated, and then a certain proportion of the tax rate of that district was given for building the sewers. He found one district with an 8-inch sewer, and another with a 20-inch sewer discharging into it. As all the sewers were eleven feet below the level of the street, you can imagine the consequences.

SECRETARY TILLSON: The writer of the paper spoke of backfilling. We have in Brooklyn a large relief sewer that ranges all the way from six to fifteen feet in diameter, and is from twenty-five to seventy-five feet under ground. This has been constructed for twelve years. Nearly all the streets have been paved with asphalt. For two or three years we have had a great deal of trouble owing to the settlement of the street over the sewer. The soil is gravel and sand and ought to be easily backfilled. Of course in these deep trenches there had to be a great amount of bracing material. I think the reason the earth stood for eight or ten years and then began to settle was because it was not properly backfilled. We have had to repave at a great deal of cost.

In another place, where the rapid transit people are building a tunnel under the river, in going down one street where the soil is almost all clean, sharp sand, and where the tunnel is being built under the pilot system with only a space of an inch between the outside shield and the ground, and where grout made of Portland cement is pumped behind every segment of the tunnel, and pumped in with as much force as possible, they have settlements which have caused the fronts of houses thirty feet away to crack, and for blocks the entire width of the street has settled from three to six inches. I walked over that street the other day with the engineer in charge of that work. He had a profile made previous to the settlement and one made since. In many cases one could see where the roadway simply had settled, but in other places the entire street, from house to house, had settled from three to six inches. I went into the tunnel and saw how the work was carried on. It seemed to me that every precaution was taken to prevent settlement, yet there was that settlement of three to six inches in the street.

MR. ADAM: How would you overcome the settlement in the asphalt street?

MR. TILLSON: We are stripping the street for the entire width of the sewer tunnel, and then digging down and flushing with water.

MR. ADAM: Are you going to repeat that a number of times?

MR. TILLSON: We kept it up for four or five days.

MR. ADAM: I thought you might dig down three or four feet and then re-tamp.

MR. TILLSON: We wanted to find the cavities that already existed.

MR. ADAM: How do you expect to accomplish that? The cavities may be below where you have dug.

MR. TILLSON: We can not tell whether they are there or not. We did not dig down the entire depth.

MR. ADAM: In one case where a sewer had been built seventeen years previously, when the street was paved—fortunately this was done by the same contractor that built the sewer—the entire width of the excavation settled.

MR. FISHER: The element of time has very little to do with compacting the backfilling of a sewer that is imperfectly done at first. We have much more trouble with the sewers built ten and twelve years back than we have with sewers built at the time the pavement is built.

In the matter of local sewers, so far as possible, we put their construction into the same contract with the pavement. This makes one contractor responsible for the settlement of the pavement. Where sewers have been built ten or twelve years we have had to dig up the entire backfilling down to the sewer and replace it, tamping it properly, in order to support the pavement. We find that a crust forms over the top, eighteen inches or two feet in depth, and when we make the excavation and take this off the backfilling under that is in the same condition as when it was first put in.

President Ballard: The next paper will be on "The Pollution of the Passaic River," by Mr. Adam.

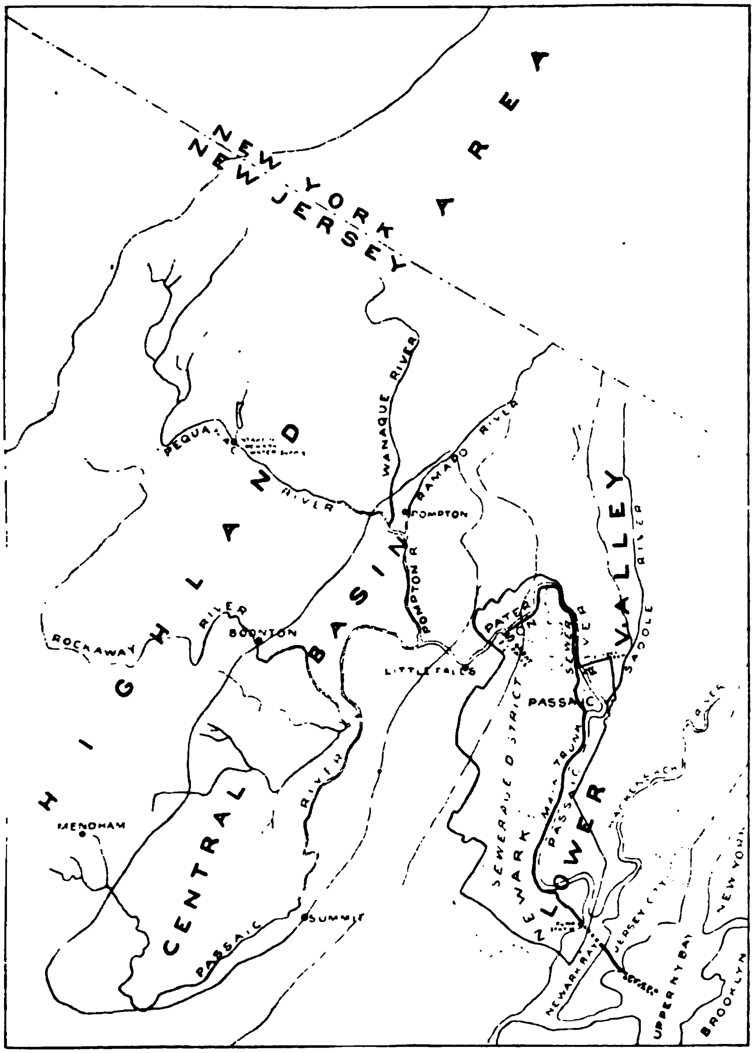
Mr. Adam: I have made a diagram to accompany the paper. I think the paper will be more readily comprehended if you have a picture to look at while I am reading.

The subject of my paper is "The Pollution of the Passaic River," but the pollution of streams in almost all cities located on the banks of such streams will have to be contended with. The matter has been before our municipality for the past six or seven years. While I have not had any direct charge of the matter I thought the matter so interesting I wrote the paper with the title that has been announced:

THE POLLUTION OF THE PASSAIC RIVER, A STREAM IN THE NORTH-EASTERN PART OF THE STATE OF NEW JERSEY, AND THE INTENDED REMEDY.

BY ERNEST ADAM, NEWARK, N. J.

The Passaic River is the principal stream in the State of New Jersey. Its drainage area contains 949 square miles, 132 of which are in the State of New York. The Passaic proper rises in Mendham, Morris County, 600 feet above tide, and flows in a circuitous course for a distance of 83.5 miles, into the Newark Bay, through which and the Kill van Kull it connects with the upper bay of New York. Navigation in the Passaic River is confined to the tidal part, which extends to the city of Passaic, about thirteen and one-fourth miles above the head of Newark Bay; the mean rise and fall of tides in the bay is 4.7 feet; at Passaic it is about 3.3 feet. The natural available depth in the river was 7 feet at mean



SCALE - 2 MILES TO ONE INCH

low water for a distance of about four and one-fourth miles, and at the city of Passaic it was three feet.

The whole drainage area has been divided into three characteristic sections, viz: Highland Area, Central Basin, and Lower Valley.

The Highland Area covers 483 square miles, and is the gathering ground of the principal tributary stream; it also contains a number of lakes and artificial reservoirs, the latter for storage of water to supply municipalities. It is a mountainous region composed of granitic and crystalline rocks, having a general altitude of about 1,000 to 1,500 feet above sea level, containing many ridges and vallies, the latter ranging from 300 to 500 feet below the crests. The population of this area is only 64 persons to the square mile, and is largely concentrated in a few towns; the remainder is comparatively unsettled.

The Central Basin contains 290 square miles of the drainage area, 46 of which are marsh or wet lands; the average elevation of the floor of the basin is about 180 feet above sea level, and that of the abrupt hills bordering the basin is about 600 feet above sea level. This is an agricultural territory, containing an average population of 120 persons to the square mile, but also relatively centered in a number of large places: The Passaic River proper enters this basin as a small stream, and passes through it in a meandering course, until it reaches the abrupt outlets of the basin at Little Falls and Paterson; the drop at the first place was about 40 feet (now reduced), and at the second place, 70 feet. All but one of the principal tributaries discharge their waters into this basin, and as these streams have a sharp descent their contents, during and after heavy rains, are poured so quickly and in such volumes into the flat area, that the water is unable to pass the outlet at Little Falls, causing large portions of the wet lands to remain under water for days and even weeks.

The Lower Valley section, extending from Little Falls to the Newark Bay, contains a drainage area of 176 square miles; the Passaic River measuring 29.1 miles between these points. About nine miles below the city of Paterson the waters of the river are held by the Dundee dam, which is 450 feet long, and its crest is 27 feet above mean tide; the storage area covering 224 acres. From the dam to the city of Passaic, a distance of four miles, the river has a total drop of 6 feet; from this point to the Newark Bay, thirteen and one-half miles, it is a narrow tidal estuary. In a portion of the Lower Valley district, containing about 60 square miles, there are over forty cities, towns and boroughs, representing an aggregate population of about 4,200 persons per square mile; the natural advantage of the water front on the lower Passaic, the water powers at the cities of Paterson and Passaic, the great railroad facilities, and the proximity to the city of New York, have all contributed towards the concentration of so large a population.

The water powers of the Passaic River were among the first used in the country. The Society for Establishing Useful Manufactures was formed in 1791, for the purpose of developing the large power existing at the "Great Falls" of the Passaic at Paterson. Other powers of less magnitude were founded along the main stream and some of its principal tributaries; the next largest to that at Paterson is the one of the Dundee Power Company near the city of Passaic.

With the favorable increase of population and industries in this district of the Passaic River drainage area, followed the establishment of water supplies and the consequent construction of sewerage and drainage systems.

Previous to the year 1871 the public water supply of Newark was obtained from series of springs, although the population in 1870 was nearly 106,000; but in those years and even for some time after a great many of the inhabitants used water from private wells. From 1871 to 1892 the public supply was taken from the Passaic River at a point about four and one-half miles above the center of the city. Jersey City, the next largest in population to Newark, in the state, also procured its public supply from the same source, about three-fourths of a mile below the works of Newark. Apparently no serious consideration was given at the time the river supply was selected to the fact that the Passaic was a tidal stream at those points and even further up, and to the arising danger of pollution from domestic and industrial wastes above and below the intakes, especially from the rapidly growing city of Newark. Neither of the cities used mechanical filtration during the years that the water works were in operation; the one of Newark was abandoned in 1892, and that of Jersey City in 1896.

The abandonment of these supplies was an absolute necessity for the preservation of health of the inhabitants of the two cities; the water was also obnoxious to sight and smell. In 1890, Albert R. Leeds, Ph. D., was called upon by the authorities of East Orange to make an analysis of the effluent from the sewage disposal plant; the sewage being subjected to chemical treatment and intermittent filtration. In his letter to one of the Examining Committee of East Orange, the doctor stated: "I would feel less sense of danger in drinking the sewage effluent, as per samples sent from the East Orange sewage disposal works, than drinking the water of the Passaic River supplied to the inhabitants of Jersey City. Taking the albuminoid ammonia as the measure of sewage contamination, the Jersey City water, with 0.01 grains per gallon, contains six times more sewage than the effluent waters from the disposal plant." To cite another case of the condition of the Passaic water, although after the practical abandonment of the Newark supply. During the severe cold spell from February 13 to 18, 1899, the draught on the available new water supply was so heavy that it was deemed necessary by the officials in charge, for protection in case of fires, to supplement it by drawing water from the river at the old pump works; while the total quantity used during those days was 218 millions of gallons, 63 millions were river water. An outbreak of typhoid fever and intestinal diseases followed and during the three following months 395 cases of typhoid had developed in the city, as against eight in the same three months of 1898. The dangerous character of the Passaic water was thus demonstrated, and at a time of the year when its noxious quality was likely to be rather less than at other periods of the year.

The city of Newark is now drawing its water supply from the upper catchment area of the Pequanac River, in the Highland area (considered one of the best water supplies); Jersey City from the Rockaway River drainage area above Boonton; both the these rivers are principal tributaries of the Passaic River. The cities of Paterson and Passaic are receiving their water supply from the Passaic River near Little Falls, under contract with a private company, which has a mechanical filtration and pumping plant at the intake. The two last mentioned cities never procured the water for domestic use at any time below the Great Falls at Paterson; nor any of the other communities in the Lower Valley section to my knowledge.

In the year 1856 the first trunk-sewer was built in the central section of the city of Newark, with its outlet directed into the Passaic River. The discharge into the stream was such a convenient and inexpensive method, and one which was almost universally adopted in the earlier years by communities which had natural water courses conveniently to hand. It may be said in mitigation of that practice that the dangers of pollution were then not realized, nor even anticipated; the different methods of sewage treatment practically undeveloped.

The sewerage system of Newark was extended from year to year, keeping about equal pace with the extension of the water supply system, and thereby increasing and intensifying the pollution of the Passaic River; the same might be said of the other municipalities which are located on the banks of the river or adjacent thereto, within the Lower Valley section.

Only a few years after the domestic water supply from the Passaic was abandoned by Newark and Jersey City, a general agitation was inaugurated by the people along the river and adjacent thereto, to obtain some remedy of the nuisance created by the filthy condition of the stream. It was claimed that in hot, sultry nights there was a necessity of closing the windows of houses within a reach of a half mile from the river banks, in order to avoid the nauseating effect of the odors.

In a report of the United States government of the flood of the Passaic River in 1902, the pollution of the lower section of this stream is considered one of the most aggravated cases to be found in the United States.

The almost universal and continual agitation brought the matter into the State Legislature. In the session of 1896, an act was passed for the consideration of a general system of sewage disposal for the valley of the Passaic River and the prevention of the pollution thereof. The synopsis of the act was that the governor shall appoint three persons for the purpose of considering the subjects referred to, with the power of employing engineering and other assistance in order to carry out the intent of the act. They were to consider the various methods of disposal of sewage and the application of such methods to the whole or any portion of the territory, and to submit a printed report of their conclusions to the legislature, without unnecessary delay. The title adopted by the appointees was "Passaic Valley Sewerage Commission."

The Commission found Summit, Union County, the only municipality, in the upper reach of the Passaic Valley, having a sewerage system and discharging the effluent from filtering beds into the river; it is stated that the evidence of contaminations practically disappears before reaching Little Falls (a distance of about 26 miles between the two places).

It has been said that the odors arising from the filtration plant were objected to by people living in its vicinity. Perhaps for this reason and for the purpose of economy, Summit has already or will soon abandon this plant, and connect the system with a gravity sewer which discharges the crude sewage into the Staten Island Sound, within the precinct of the City of Elizabeth. The main gravity sewer was built and is maintained jointly by seven different municipalities, not including Summit.

The commissioners also found some private drains at various points, but of no consequence, and considered the river about Paterson in a generally fair condition.

After the Passaic passes the Great Falls at Paterson its character is completely changed; between that point and the Newark Bay it receives about 70 million gallons of sewage in 24 hours; the area drained by this part of the river is now inhabited by about 500,000 persons. The condition is of course aggravated during a protracted dry season, but during freshets and floods the high waters serve to temporary cleanse the river from the excess of sewage.

According to table No. 53, Geological Survey of New Jersey, 1894, the estimated flow in the dryest month of an average year is 250 million gallons per day, from the entire drainage area; and for the wettest month of an average year it is 1,556 million gallons. In the flood of 1882, which was considered the greatest in that century, the maximum flow was 18,265 cubic feet per second, or at the rate of 11,834 million gallons in 24 hours; but the flood in March, 1902, broke that record, as the maximum flow at Dundee dam was estimated at 22,677 second-feet. Yet the flood in October, 1903, exceeded them all, the maximum flow, gauged at the same point, was estimated at 31,410 second-feet. It is evident that these volumes of water not alone purified the river, but scoured everything and anything within their reach.

The territory considered by the commission for which relief was intended is 83.13 square miles, or a little less than half of the total area of the Lower Valley section; it contained 18 cities, towns, boroughs and other municipalities, twelve of which were discharging crude sewage into the river. The population as per state census of 1895 was 436,423.

After giving due consideration and study to the problems before them, the commission, in conjunction with the engineers, decided to recommend the construction of a joint main intercepting sewer along the west bank of the river, reaching from Paterson to a short distance beyond the southern limit of Newark, a distance of about 24 miles. At that point it was contemplated to erect the main pumps to lift and discharge the sewage, after sedimentation, into the Newark Bay through an outfall-sewer about two miles long. If in later years it would prove necessary to divert the sewage from the Newark Bay, the method was suggested of conducting it to the outer harbor of New York near the eastern shore of Staten Island.

The intercepter was to provide sewerage facilities for a period of thirty years; with an allowance of 150 gallons of water per person, per day, and an estimated population of 1,500,000. The estimated cost of the work was $6,500,000 for construction; the cost of operating in the beginning $125,000, and ultimately $300,000.

The commission in its report shows the expense of treating the sewage of London, at Barking and Crossness, in 1895. The amount of sewage treated was 250 million gallons per day (about the same amount as estimated for Passaic Valley district), from which were extracted 6,000 tons of sludge by means of 67 tons of lime, besides other chemicals; the operating expenses for the year were $507,000, and the cost of the two precipitation plants and of the ships used for transporting the sludge was $4,729,000.

When these enormous sums of money are considered, it is not to be wondered when a community or communities take advantage of their proximity to deep sea water, by discharging their waste-waters into it, although this method may not be in harmony with scientific advancement.

Another act was passed in 1898, giving the governor the power to appoint commissioners "to consider the subject of the pollution of the rivers and streams within the state and to provide a plan for the prevention thereof, and for the relief of the persons and property affected thereby, and to provide for the expenses necessary for the purpose."

The commissioners in considering the pollution of the Lower Passaic particularly, sent a general form of inquiries to the communities within the drainage area of the proposed sewer. The most of them were in accord with the plan of a main intercepting sewer, as was outlined by the former commission, stating that there was not suitable and sufficient land within their own domain to treat the sewage in some manner, and that it would not be likely that they could locate a plant within the boarders of another. The person responding for the City of East Orange mentioned the costly experience which that municipality had in chemical treatment and intermittent filtration of its sewage. The plant had cost about $100,000, and the treatment nearly $25,000 per year, for a daily flow of 1,330,000 gallons, of which over one-half was ground water.

In this instance there is a case where the admittance of ground water into conduits of a separate system, as was considered beneficial or harmless by some members of the Society at last year's convention, had proved to be expensive. The plant was abandoned about ten years ago.

Another commission, consisting of five members, was organized in 1899, called the "State Sewerage Commission." Under this act power was only given to veto new sewerage systems which the commission might deem injurious to the public, as its consent is required for new systems. The commission considered it necessary to give it additional power in order that it might compel municipalities already having sewerage systems, to adopt measures whereby injury would be prevented to the streams and the owners of property along their banks.

This commission also sent circular letters to all municipalities in the state, seeking statistical information as to the local population, topography of site, water supply and consumption, and various items relating to sewerage. This was a step in the right direction and of considerable value to a commission of this kind.

In the session of 1900, the legislature pased another act amendatory to the previous one, concerning the State Sewerage Commission; it also authorized the creation of sewerage districts and sewerage district boards, making the members of a board elective from the established sewer districts, and a body politic and corporate; with powers to construct sewers and drains within the district, and to bond the same for moneys required. This was another step in advance of relieving the Passaic River from its pollution. I must add, however, that no elective board was created, as the law was again changed.

The State Sewerage Commission submitted a report to the legislature of 1901, which principally related to devising a system or systems of sewerage in the Lower Valley district. Having procured additional powers and monetary means, the commission divided the sewerage district into two sections for each of which they appointed engineers who were familiar with their respective territories, to study and report upon several methods of sewerage and sewage treatment, which were defined by the commission, and also to report upon the probable cost of each device.

After the plans and dates were received from those engineers, the whole matter was submitted to three consulting engineers, who were selected by the commission, being Messrs. R. Hering, J. J. R. Croes and William M. Brown. I quote a part of their report verbatim: "We are satisfied, after careful examination of the proposition to this effect, elaborated by Messrs. Fteley and Jacobson, in 1897, and the more detailed studies of Messrs. Wise, Watson and Ferguson, and Mr. Owen, made under your direction, and by our own studies of the question, that a union of all the communities which contribute to the pollution of the Passaic River, in constructing a single trunk sewer from Paterson to the southerly boundary of Newark, and arranging for a joint final disposal of the polluted waters, will be more economical in construction and maintenance, then the construction of separate transportation conduits and disposal works for separate communities, or than any combination of two or more such communities with separate works for disposal."

The plan proposed by the consulting engineers was to some extent the same as was outlined by Messrs. Fteley and Jacobson, with the exception of having only one pumping station on line of the main trunk sewer, and the outfall sewer to discharge into the Upper New York Bay, instead of the Newark Bay; the discharge into the former will be 40 feet under water surface, and close to a main current which is 70 feet deep. The same ultimate population of the entire district was also estimater at one and one-half million; but the sewer was increased in size so that it would convey, at its lower end, 270 million gallons of sewage per day, instead of 225 million as previously assumed. Newark and Paterson are the only places within the new sewerage district, where the present sewers are designed to carry sewage and storm water combined; the amount of sewage per day to be contributed by each, was assumed to be 250 gallons per person, 100 of which was assumed to be contributed by the first wash of the streets during a rain fall.

Finally the matter was entrusted to a district board, appointed under a new act of the legislature, approved March 27, 1902, "authorizing the appointment of commissioners in sewerage and drainage districts, created for the purpose of relieving the streams and rivers therein from pollution, and to provide a plan for the prevention thereof, and providing for the raising, expenditure and payment of moneys necesary for this purpose." Its title being Passaic Valley District Sewerage Commission.

In the report submitted by the Passaic Valley District Sewerage Commission to the legislature of session 1903, it acknowledges the receipt of maps and other valuable information from the State Sewerage Commission, but also stated that their findings in the case were reached by independent investigation. Mr. Rudolph Hering was also chosen by this commission as their consulting engineer.

The route of the main sewer selected by the commissioners is practically the same as was recommended by the other, but a greater capacity was assumed, based on a flow of 326 million gallons through the terminal part when running only three-quarters full; the estimated population was also increased to 1,617,000.

The total length of the main intercepting sewer is to be nearly 21⅓ miles, its size varying from 4 to 13 feet, and with a difference in elevation of the inverts of .54.6 feet, the invert at the lower end being 25.5 feet below mean highwater. The maximum lift at the main pumping station will be about 40 feet. The outfall sewer from the pumping station to the Upper New York Bay consists partly of two lines of 6 foot force mains, of a 13-foot gravity brick sewer and of one line of 8-foot steel pipes in all 5¼ miles in length. The total estimated cost of the main and branch sewers, about 37 miles in length, together with the appurtenances is $8,691,400, including contingencies and supervision. The maximum estimated cost of maintenance is $544,500 per annum.

The cost of construction is to be assessed upon the different municipalities within the sewerage district, in proportion to the respective tax-valuations, and the cost of maintenance in accordance with the quantity

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of sewage discharged into the main intercepting sewer; the same methods which had been applied by the Metropolitan Sewerage Commission, of Boston, Mass.

In the case of the Joint Tide-Water Sewer, before alluded to, the cost of construction was to be assessed according to an estimated use, not an actual use, that is, the population of each municipality participating in the scheme was estimated; likewise the consumption of water; these factors were different in each case, and from them was deduced the quantity of sewage to be contributed. This method was considered more just and definite than the one based on tax-valuations, being claimed that the tax-valuations and rates vary in different municipalities, some having low valuations and high rates, and others the opposite, which is true. But of the two methods, I think the one adopted by the sewerage commissioners is the preferable one: it makes the wealthier community help the less wealthy in case where mutual action is required for the preservation of health. This is in keeping with what Rev. Henry Ward Beecher once said at one of his lectures, "it was the duty of the rich people to see to it that the homes of the poor ones were kept clean, because both classes were exposed alike during an epidemic."

The governor of the state of New York had appointed a committee to examine the matter of discharging the sewage from the trunk sewer into the Upper New York Bay, although the point of discharge is quite within the domain of New Jersey; this committee has made an examination, but no report of it is known of.

The Passaic Valley Sewerage Commissioners also took the precaution of securing the opinion of the United States officer in charge of New York harbor and vicinity, in relation to the intended discharge of sewage; his opinion was that it would not interfere with navigation or form an obstruction, especially as it was intended to remove the floating particles of the sewage and settle the heavy ones before the sewage is pumped.

A number of expert engineers were also engaged by the commissioners to investigate the subject of tidal action in the Upper New York Bay. One of the experts stated that it can be safely assumed that 7,000 cubic feet of water passed down the current during an ebb, at the proposed point of discharge; whereas the full capacity of the trunk sewer is about 44 million cubic feet in 24 hours.

In the writer's opinion, it was a fortunate case for the different municipalities to have such a remarkable advantageous point of discharge at their command and selected for them.

The commissioners have not begun any work upon the intended sewerage system. In September, 1903, Paterson, the second largest city in the district, contested the constitutionality of various points in the act creating the Passaic Valley Sewerage Commissioners. The Supreme Court, in July of this year, declared the act constitutional in all its parts, but Paterson carried the case into the highest court of the state, where a decision upon it is expected next November.

It will have been noticed that quite a number of years have passed to bring this sewerage problem to the present condition, and more will pass by before this system is in working condition. But this is the case with all good things; they want time to mature.

In preparing this paper the writer has copiously drawn from the various reports relating to the subject; he was only connected with the matter so far as it was incumbent upon him as former engineer of the Department of Sewers and Drainage in the city of Newark, in providing dates and plans appertaining to the problem within the city limits and in attending various meetings held for the purpose of promoting the subject. He was also an agitator for the discharge of the sewage into tidal water, without previous scientific treatment, on the principle of permanent economy.

Newark, N. J., Oct. 1, 1904.

Mr. Owen: There is one particular problem about the relief of the pollution of the Passaic River, and that is the treatment of the tidal water. The engineer in charge of this work in Boston told me that previous to the construction of the system that has been built in Boston the water of the bay was as bad as the water of the Passaic now is. In the larger cities of Europe the sewage begins to be injected into the river from a thinly populated district, and the population gradually increases as the river passes along through the city, and finally reaches its culmination as the sewer passes out of the city. In this case we have a different proposition. The city of Paterson has now about 120,000 population. That city discharges its sewage at what is practically the upper end of the canal. Then we have an attenuated population until we reach Newark, where the sewage of that city is injected. Experiments have shown that the injection of sewage at certain conditions of the tide causes it to be carried up to Newark. This trunk sewer was not constructed to carry anything more than the sewage water. Of course we assume the daily flow of sewage is fairly constant. We have also to assume that the first rush of the storm waters should be injected into the sewers as well. After that the sewer is supposed to be filled and the balance will pass off in the natural channel and be carried to tide water. The question of the first rush of impurities is a very delicate matter. To my mind it is a suggestion that is entirely tentative. We have no precedent as to what volume of sewage will run down through this river after the main sewer is filled. We have no knowledge as to what will be the effect of that volume of water. If it is a short storm it will be carried away quickly; but if a storm lasts three or four days and the flow of sewage is constant, of course the river will be polluted. The question is how long that rush of sewage will stay in there, even after the storm sewer is constructed.

MR. ADAM: You mean the overflow of the storms?

MR. OWEN: After the first rush, the rest of the water flows into the Passaic River, and of course carries sewage with it. The problem is, what will be the effect of that large volume of pollution being carried into the river on the tide water?

MR. ADAM: In a report of the Columbus, Ohio, sewer it is said that they considered it safe that after prior sedimentation the sewage from 1,000 persons would be safely diluted by a river flow of four cubic feet per second and is rendered inoffensive thereby.

MR. BROWN, Indianapolis: I may be able to give a little practical instance that will answer the question. We investigated the flow of sewage into the Hudson River at Albany. That is not a separate system of sewage, but of course at times, when there is no rainfall, the sewage comes in without dilution. The Hudson River is also a tidal stream. The sewage of Albany is carried several miles up the stream from the outlets of the sewers. Not only that, but some of the sewage is discharged into a sort of bayou behind the island, so that it flows past the island and then with the rising tide flows up stream again. The only point I wish to make is that in examining that water with reference to the effect of the sewage pollution upon it, in several instances when we examined it we found no material increase in the proportion of pollution. The amount which we found seemed to depend upon the dilution of the sewage. There was no increase in the amount of sewage deposited in the bottom, so far as we could tell, or in the water itself. I think probably in the case which the previous speaker mentioned, where there was only the overflow of the sewage coming into the stream at a time when it was diluted by the water, it would have considerably less pollution than we found in the Hudson.

Mr. Adam: The gentleman from Little Rock quoted a case that may be a warning to other cities. In this case engineers think the probability may arise that some of the combined sewers of the cities of Paterson and Newark will have to be changed so as to have a separate system on account of the great flow of the water, and the cities will be taxed for their maintenance according to the amount of sewage discharged, which of course means also this overflow or the first wash. Even where the cities have the facilities for establishing a combined system, while it may be more economical in the first place to adopt that system, it will be much more profitable in the long run to adopt the dual system. An advantage will accrue to all the municipalities which have adopted the separate system if they will adopt the dual. Newark will have to pay about five millions, according to the tax valuation, and the maintenance will be very great. We have a great many sewers that carry ground water. The engineers that have this work in contemplation intend to construct part of the main sewer in concrete, thinking they willget a more impervious sewer than if it is done with brick work. I think, however, no sewer can be built that will be absolutely impervious to water. As I stated in my paper, it is going to be a great problem to keep out ground water and also to introduce a separate system. It is only a matter of years when this problem will confront every municipality, and they will have to consider purifying the sewage before it is discharged into the streams. I believe the separate system is the more sanitary. In large cities you have not enough velocity in the flow, and after heavy rains the settling is apt to remain in the sewer and make it unsanitary instead of sanitary.

President Ballard: We will now have a report of the Committee on Taxation. Mr. Rust is chairman of that committee.

Mr. Rust: We have not had a meeting of the committee, therefore I have no report to make. I prepared a short paper, but have not brought it with me as I did not expect the report of the committee would be called for at this session. It is not a paper that will require much discussion, and I think if you will take it without reading and have it printed it will be just as well. I ask now to have it taken as read and incorporated in the Proceedings.

LOCAL IMPROVEMENT ASSESSMENT IN TORONTO.

BY C. H. RUST, TORONTO, ONT.

I regret very much that I have been unable to obtain a meeting of the Committee on Taxation and Assessment and therefore am unable to present a report.

In connection with this matter, I think it would be advisable in future to appoint as chairman of the Taxation and Assessment Committee, an official who has made a special study of this branch of municipal work. Engineers are well qualified to spend the taxes but I do not think they are as competent to discuss the question of taxation and assessment. The Society might also consider the advisability of amalgamating this committee with the City Government and Legislation Committee.

I have prepared a few notes on the system adopted in Toronto of raising funds for the carrying out of necessary improvements, which will enable the members to compare Canadian methods of taxation with those adopted in American cities.

The Municipal Act, under which all Canadian cities and towns are governed, empowers the city council to pass a by-law for the construction of sewers, roadways, sidewalks, etc., under what is known as the local improvement system, and,

"For assessing and levying by means of a special rate, the cost of deepening any stream, creek, or water-course, and draining any locality, or the cost of making, enlarging or prolonging any common sewer, or of opening, widening, prolonging or altering, macadamizing, grading, levelling, paving or planking any street, lane, alley, public way or place, or of constructing any sidewalk, bridge, culvert or embankment forming part of a highway therein, or of curbing, sodding or planking any street, lane, alley, square or other public place, or in any case where a system of waterworks has been constructed by such municipality, then for providing for the cost of the extension within the limits of such municipality of branch mains and pipes, and all other work necessary for connecting the properties of the property owners with the waterworks system of said municipality, in order to permit such property owners to receive the benefit of such waterworks; or, in any case where a system for lighting within a municipality has been constructed, or erected, by such municipality then for providing for the cost of the extension within the limits of the municipality of the poles, wires and pipes, and all other work necessary for lighting any street, square or other public place whereon the lands to be benefited thereby front or abut, or of reconstructing any work hereby provided for. 55 V. c. 42, s. 612 (2); c. 43, s. 65.

"For regulating the time or times and the manner in which the assessments to be levied under this section are to be paid, and for arranging the terms on which persons assessed for such works or improvements may commute for the payment of their proportionate shares of the cost thereof in principal sums. 55 V. c. 42, s. 612 (3).

"For effecting any such work or improvements as aforesaid with funds provided by persons desirous of having the same effected. 55 V. c. 42, s. 612 (4).

"If the contemplated work of improvement is the construction of a common sewer having a sectional area of more than four feet, one-third of the whole cost thereof shall be provided for by the council. The council of every municipality which has not passed a by-law within and under the provisions of section 682 of this act, shall also provide in connection with all sewers, the cost of all culverts and other works necessary for street surface drainage, and also the cost of that part of every such work, improvement or service which is incurred at and is chargeable in respect of street intersections, and also that part thereof done or made opposite real property which by any general or special act is exempt from special or local assessment. 55 V. c. 42, s. 612 (5).

"If the contemplated works or improvements relate to any stream, creek, or water course, or to draining any locality, and in the opinion of the engineer or surveyor specially benefit any lands lying within the municipality or any road or roads lying therein or any roads therein belonging to any other municipality or corporation, then the engineer or surveyor aforesaid shall charge the lands, road or roads to be so benefited, and the municipality, corporation, person or company whose lands, road or roads are improved, with such proportion of the cost of the work or improvement as he may deem just, and the amount so charged for lands or roads, or agreed upon by arbitration shall be paid by such person or out of the general funds of the municipality, corporation or company, as the case may be, and the provisions of the Municipal Drainage Act so far as applicable shall apply to any such work or improvement constructed under this section. 55 V. c. 42, s. 612 (6)."

The necessary improvements are carried on upon receipt of a petition signed by at least two-thirds in number of the owners of any real property to be benefited thereby; such owners must represent at least one-half in value of such real property. The local board of health of any city or town may recommend to the council the necessity, in the public interest, of constructing certain sewers for sanitary or drainage purposes, and if the recommendation is affirmed by a vote of two-thirds of the members of the council, the work can be proceeded with in spite of opposition from the property owners, or the city engineer may recommend an improvement on the initiative principle and unless petitioned against by one-half the number of the owners, representing one-half in value, the work is proceeded with. In the case of the construction of concrete sidewalks, however, the city of Toronto has recently obtained legislation empowering the corporation to lay a sidewalk, even if petitioned against, if in the city engineer's opinion it is necessary in the public interest. The city is also endeavoring to obtain the same legislation in reference to roadways.

In Toronto the practice has been to extend the payments on sewers, asphalt and brick pavements and concrete sidewalks over a term of ten years. In the case of macadam roadways and plank sidewalks, the payments extend over a period varying from three to five years, which period is generally determined by the city engineer. On all sewers less than four feet in sectional area, the rate-payers are assessed for the total cost, excepting street gullys, which are paid for by the city.

In the case of roadways and sidewalks, the city pays the cost of the work at all street intersections, and also assumes the cost of the improvement upon the frontage allowed. For instance, an owner has a lot 25-ft. frontage on a street with a depth of 120 feet on another street. He is assesed for the full frontage of 25 feet and when the other street is paved, he is exempt for 60 feet, which is paid for by the city. If the lot is deeper than 120 feet, an allowance of only 60 feet is made. If the lot is less than 120 feet, the city pays for one-half the depth. Churches, which are exempt from general taxes, are not exempt from local improvement rates.

REPORT OF THE COMMITTEE ON PARK DEVELOPMENT AND MAINTENANCE.

The progress of the development of public grounds during the past year has been more towards park systems, small parks and playgrounds, than the large scenic park, which has been so prominent in the past. Practically all the larger cities have established additional playgrounds or are taking steps which will eventually lead to them. The right of the child to play and the obligation of the cities to furnish the opportunities for it to do so are more generally admitted. The need of the smaller neighborhood parks which are quickly and easily accessible, has also gone forward and the fourteen new parks in Chicago of this character are being furnished with a public clubhouse, with commodious assembly rooms and all the conveniences for large and small meetings, where indoor games can be played and the people can come together for social intercourse. Other cities are taking steps to follow Chicago's lead. The fact that young people from fourteen to twenty-one must have hard, continuous and strenuous work or play in order to develop their bodies and brains so that they can successfully endure and meet the conditions of after life, is also having a recognition in the establishment of outdoor and indoor gymnasiums. So great has been the energies along these lines that the large scenic park as such seems to have attracted less attention.

But in fact there also has been progress in the konwledge of how they should be developed as well as several additions being made to their number, notably among them being the development of the large park at San Diego, Cal., under the plans of Samuel Parsons, Jr., of New York.

But what is probably the most far reaching of park advancement during the year has been the steps taken towards the establishment of extensive park systems, and a park system is now recognized as having more than a number of separate parks and squares, but a well-balanced proportion and distribution of country reservations, scenic parks, small or neighborhood parks, public squares and playgrounds, connected by parkways and boulevards. There has been great progress made in the development of such systems in Boston, Bronx and Brooklyn Boroughs of New York, Buffalo, Chicago, Kansas City, Essex County, New Jersey, and other cities, and the initiative of said systems has begun in Providence, Queens and Richmond Boroughs of New York, Philadelphia, Portland, Ore., Seattle, Baltimore and New Orleans. The largest conception of the kind is what is known as "The Outer Park System of Chicago," for which a special commission has been created. Large as Chicago is in territory, this city contemplates going even outside of that. If carried out, there will be at least one hundred and twenty (120) miles of parkways and several thousand acres of additional park areas.

On the whole the year has brought a more definite knowledge of the relations of park systems and the different units of park systems, to the city as a whole, and its meaning to the people as individuals. The year has brought a great advancement in the knowledge of what park work means, has crystallized it, as it were.

Among the many valuable publications and reports of the year, probably the most valuable are J. C. Olmsted's report on a Park System for Portland, Oregon, and Frederick L. Olmsted's report to the Municipal Art Society of Baltimore on the Extension of the Park System of that city.

For the Committee,

G. A. PARKER,
Chairman.

President Ballard: I would suggest that reports of committees that are not read here, and all papers mentioned in the programme that are not read, be printed in the Proceedings.

Mr. Rust: If an official who has had something to do with that part of the municipal business is appointed chairman of this committee, I think you will have better reports.

President Ballard: I think that is a very good suggestion, and very opportune. Last year I was selected for that subject by Mr. Rust, although I knew nothing about it. However, I presented a paper. The suggestion is a good one, however, and should be acted upon.

We will now hear a paper on "The Influence of Citizens' Associations on Public Improvements," by Mr. C. C. Brown, Indianapolis.

Mr. Brown: You have on the programme before my paper the report of the Committee on Municipal Data, by William Fortune, chairman of that committee. Mr. Fortune feared he would not be present at this meeting and gave me the paper to read.

President Ballard: You may proceed with the reading of Mr. Fortune's report, Mr. Brown. You can then read your own paper.

REPORT OF COMMITTEE ON UNIFORMITY IN MUNICIPAL REPORTS AND ON NATIONAL STATISTICS.

To the American Society of Municipal Improvements:

Gentlemen: Your Committee on Uniformity in Municipal Reports and on National Statistics, has the following report to make on the progress in this direction during the past year:

The most notable occurrence of the year is the preparation by the Bureau of the Census of the Department of Commerce and Labor of schedules for the collection of the social statistics of cities and of general and supplementary schedules prepared for the collection of statistics of municipal finance. Copies of these schedules are presented with this report and also a copy of the instructions to clerks and special agents, which accompanies the blanks. We also present a copy of some special instructions supplementary to those contained in the volume.

The Bureau of the Census is acting under the law authorizing decennial collections of social statistics of cities and under the law authorizing the Bureau of Labor to collect annually the official statistics of cities having over 30,000 population. For 1902-3, these statistics will be collected for all cities of more than 25,000 inhabitants, and for the years 1903-4, collection will be made for cities of from 8,000 to 25,000 inhabitants. The office has about forty employes in the field engaged in the collection of these statistics and hopes to have part of them published before the end of 1904. It was the purpose to add to the schedules presented herewith, one regarding waterworks of cities, but it was not possible to prepare these schedules in time for use this year.

It will be noticed that the schedule of social statistics of cities is very general in its nature and does not go into even the detail which is called for in the forms of report adopted by this Society. It does not conflict in any way with the forms which we have adopted and if these reports are to be made annually, will help to develop a sentiment in favor of uniformity in accounts and reports.

The financial statistics are called for in eight schedules, namely:

G. 12-108 Municipal Finance General Report for cities containing over 8,000 inhabitants.
G. 13-112 Supplementary Financial Report.
G. 14-113 Report of Municipal Indebtedness.
G. 15-114 Report of Sinking Fund.
G. 16-115 Report of Investment Fund.
G. 17-116 Report of Public Trust Fund.
G. 18-117 Report of Private Trust Fund.
G. 19-118 Report of Private Trust Accounts.

It will be observed that none of these reports are covered by the forms adopted by this Society, although they do contain some totals called for in our schedules. I am assured by Mr. L. G. Powers, the Chief Statistician, that the waterworks schedule, if completed, would have conformed with all of our general ideas relating to statistics from such companies and undoubtedly when this waterworks schedule is prepared for some future collection of statistics, these ideas will be carried out.

In the paper by Mr. L. G. Powers, before the National Municipal League, at its meeting in April, it is said that, "To secure all the data relating to municipal finance which the members of the National Municipal League, the students of American municipal finance and the public officials of our large cities desire, called for a much more comprehensive schedule than any previously employed in the collection of such statistics. In attempting the preparation of such a schedule there has been a larger degree of success than those in charge of the work hoped for and yet the results are far from perfect. A revised schedule and set of instructions have recently been drawn up and mark a great improvement as they embody the results of the experience of the special agents in the field and the study of the employes of the bureau engaged in compiling the data on schedules."

"The municipal finance schedules and instructions, prepared by the Bureau of the Census, have played an important part during the last year in advancing this movement, having been made the basis of the schedule and instructions issued by the Secretary of State of New York for the collection of the financial data of cities of the second and third classes within that commonwealth."

"Whatever the defects of the census schedules may be they can not be charged to any lack of friendly interest or co-operation on the part of city officials. The difficulties that must be overcome before we can secure the adoption of uniform methods of accounting for all our large cities, and thus lay the foundation for truly comparable statistics, seem to me to be as follows: We must demonstrate beyond a doubt that it is possible to arrange a classification of municipal payments and receipts that shall be applicable to all cities. The census report on municipal finance will show something of the limitations within which the scheme of classification adopted by this league can be made the basis for a uniform system of accounts. I believe that scheme, with minor changes, can be made the basis of a common classification of accounts and hence of a uniform system of accounting for all our cities."

It will be seen from these quotations that there is a very pronounced disposition toward co-operation between the officials most closely interested and it is only necessary for this body to express its desire to aid in securing satisfactory schedules and in modifying the forms of accounts of the various cities represented here, so that they will conform as nearly as possible to the finally adopted schedule. The schedules of the Census Bureau are still somewhat experimental, although they have been largely improved as the result of former experiments.

It may be well to continue this committee as the official medium of communication between this Society and the Census Bureau or its duties in this regard may be transferred to the Executive Committee, as the Society prefers. It does not seem to be necessary to take any steps at present, beyond those which are to be taken by the Census Bureau, so far as forms of report and of schedules for national collection of statistics are concerned.

Uniformity in municipal reports and in collection of statistics is only an adjunct of uniformity in municipal accounts, which in turn, finds its greatest use as a convenience in the supervision of such accounts by a competent state authority. This subject is discussed by the former chairman of this committee in a paper before the Michigan Political Science Association from which the following extracts are taken:

"The movement toward uniformity in municipal accounting began some years ago, largely in the desire of municipal officials to make comparisons of their work with that of others in the same line, and in the fact that under present conditions such comparisons are all but impossible. Some progress has been made in this direction, but it is evident that the requests of any number of societies can be of but little value in changing forms of accounts and reports, and that such laws as that of Ohio produce in two or three years results which it would take generations to produce in any other way.

"It seems to the writer that the step taken in Ohio is the greatest advance which has been made. What is needed is expert control, supervision and periodical inspection of accounts by a competent state department. Uniformity in municipal accounts is an essential of the easy and economical application of a law with these provisions.

"Uniformity in municipal reports is desired by many officials of all departments of government. It is attainable without absolute uniformity of methods of accounting, but it is very difficult, if not impossible, under present conditions. It is doubtful if a provision merely for uniformity in reports would be considered of sufficient value by legislators to be established, though it would be of great value, but it is an essential part of the more inclusive law and the sentiment in its favor can be made to add to the influence needed to secure the enactment of the law.

W. B. HOWE
City Engineer, Concord, N. H.
Third Vice-President, American Society of Municipal Improvements

"The national law requiring the collection of municipal statistics is an additional source of such influence, both in itself and in the efforts of the government officials to get the data required in such form as to be valuable.

"Let us work then for the state control of the accounts of the various taxing bodies of the commonwealth and all the rest that we desire will come to us without further effort."

Respectfully submitted,
WILLIAM FORTUNE,
Chairman Committee on Municipal Data and Statistics.

THE INFLUENCE OF COMMERCIAL ORGANIZATIONS UPON MUNICIPAL IMPROVEMENTS.

BY CHARLES CARROLL BROWN, CONSULTING ENGINEER, INDIANAPOLIS, IND.

In the past the American has considered the city as a component part of the political organization of the nation and has chosen the administrators of municipal affairs for their views on the tariff or territorial expansion or many another question as far removed from the actual problems of a city government. To be sure a city is a creature of the state, but so is a business corporation of any sort. They all have their charters or franchises or articles of incorporation setting forth their rights and duties, their officers, their methods of electing them, their times and methods of settlement, and in an increasing number of states their periodic reports of operations and results to a designated state officer. They are all in equal degree corporations formed for business purposes, and it is just as appropriate to select the president of a bridge company for his views on the silver question as to select a mayor because he is sound on the doctrine of anti-imperialism.

Election as mayor or as councilman does not make a man a sanitary engineer or a waterworks superintendent or a financial expert, as so many who have obtained these offices seem to think, and, like the bridge company, the city should select men to manage its operations who are competent by experience, training and judgment to carry on its business. A number of capitalists who have decided to enter into a manufacturing business do not trust themselves with the technical details but they employ men, as expert as they know how to select, to take care of this part of the business, reserving to themselves simply the formulation of the governing policy of the organization and its financial direction. This is what the cities need to do. The voters correspond to the stockholders, and when they have selected directors, i. e., mayor and councilmen, they should elect them to carry out certain policies of local government and improvement. But the actual performance of the technical carrying out of details of the work decided upon under these policies should properly be delegated to men expert in their respective lines whose thoughts are on their duties and not upon the question of how to get a lot of votes at the next election in favor of a tariff for revenue only.

Each year sees an extension of the idea that the municipality is a business organization and should be managed on business principles. Much of this advance is due to the influence of organizations of public spirited men who have seen the defects in the system of their city government and have set out to find methods of correcting them. New York, Chicago, and San Francisco are notable for the success of their Merchants' Associations, Citizens' Leagues or other similar bodies, and their influence upon city government from the formation of the charter to the presentation of an "Isle of Safety," is very great. If the Commercial Club of Indianapolis is largely used as an illustration in what follows, it is because the author is better acquainted with its work, not because it is exceptional, although it has probably had a greater influence upon the development of its city than has any similar organization upon a city of like population. New York, San Francisco and Indianapolis are almost entirely indebted to such organizations of business men for their present charters.

The Commercial Club of Indianapolis was formed by a few public spirited business men; first, to help to make known the city outside; and, second, to improve its condition within.

One of the early projects of the Club was a paving exposition to awaken interest in the improvement of the city's streets. This exposition was noted throughout the country. It was soon found that the city could not proceed with sufficient rapidity in improving its streets on account of the defective nature of its charter. The Club therefore proceeded to the study of the question and with expert legal assistance prepared a charter as nearly like a business document for business men to do business under as the politicians would permit to pass the legislature. The result has been the making of a new city and a doubling in population in the fifteen years or so since the old circumlocution office called the city council, which was the paradise of "grafters," though the term was not then in use, has been abolished and the responsibility has been concentrated so that derelictions of duty can be promptly and properly located. San Francisco's Merchants' Association has done a similar service and is equally deserving of credit. Other instances will occur to those who read this.

But these clubs and associations do not stop here. On the other hand this is but the beginning. Party organizations we have always with us and there is a mixture of national questions in every election, though local needs have far more influence in local elections when they are separated by a whole year from state and national elections. The voters seem to forget also that they are stockholders in the great corporation and are liable to elect the directors with reference to other qualifications than their ability to manage large affairs. The Commercial Club continues to act, therefore, as a committee of the more serious-minded stockholders to watch the officers they have elected and to aid them by its advice and admonition.

Sometimes this advice is offered directly; sometimes it takes the form of influence of public opinion; very often it is requested on account of the desire of the city officials to secure the best advice it can find, usually, but occasionally that the responsibility for a procedure which they fear will be unpopular may be shifted. A few examples will show what different methods may be adopted. Those of the most recent years are cited and the list could be indefinitely extended.

A hot water heating company found itself unable, for reasons unnecessary to repeat at this time, to pay dividends upon its stock, and asked for a new franchise with an increase of rates. At once the Club appointed a committee to investigate the matter. The municipal officials requested this committee to submit its report to them, postponed its own investigation and did not employ any expert assistance, the plans of the Club's committee contemplating that sort of investigation. The engineer's report was presented with the conclusions of the committee and the Board of Directors of the Club, and forms what is termed by members of the city government a valuable part of the documentary evidence upon which the decision regarding the granting of the new franchise is based.

A Civic Improvement Association was formed under the auspices of the Club with the same executive officer. Soon after its formation floods carried away a number of the city's bridges. The Association's Bridge Committee took up the matter and make a strong point of the desirability of artistic treatment of the new bridges. It soon developed that there were several authorities interested in the question, some of one political party, and some of the other, and the city, with no money and but little remaining credit, and the county, depending for appropriations upon a county council with enough members suspicious of the responsible directors of the work (of the other party) to prevent the passage of appropriations, were apparently unable to produce any results. The Commercial Club thereupon called a meeting of all the authorities interested, both city and county, and of representatives of various business organizations and at this meeting the plan of a Bridge and Stream Improvement Commission was evolved to contain the official engineers of the city and county and four citizen members, engineers and business men. Whereupon the Club appointed this commission. Its first success was, with the aid of other influences which were brought to bear, and with a promise to supervise each step of the proceedings, to secure from the County Council a unanimous vote for an $850,000 appropriation for the first lot of bridges. It has since been called upon for advice regarding methods of improvement of streams, the formulation of plans for bridges and the letting of contracts for bridges. In this case the committee acted as a center of communication for the various interests, some of which were conflicting, not on the question of the bridge, but on questions of partisan politics. As a body of responsible citizens of high standing and in whom all have confidence, and whose decisions upon all questions, technical and practical, are accepted as unbiased and honest, its influence upon the appearance of the city so far as it depends upon the condition of its streams and bridges will be felt frequently for many years and the first results will show in completed work next year.

The Civic Improvement Association spoken of may be considered as one of the supplementary organizations depending for its present existence upon the Commercial Club. Its influence upon the care of streets, yards, school grounds, trees, birds and flowers is large and is growing, and it will often have opportunities to impress itself upon the city. It is the originator of the bridge and stream improvement movement and is now considering a practical aid toward emphasizing the grouping of public buildings which is beginning to show possibilities of great beauty, thanks in part to the original plan of the city and in part to fortunate though unplanned selection of sites for recent additions to the public and private buildings in the city.

About ten years ago the Club appointed an Elevated Track Commission which began its work with the aid of the city engineer at that time, by preparing a sketch of a plan for elevating at least a portion of the tracks of the city. This committee has been persistent in season and out of season in its efforts to arouse public opinion to the point of demanding complete relief from present conditions and to secure necessary legislation. Thus far its efforts have not met with much practical success in the way of elevated tracks, but the end comes nearer each year and a first step will soon be taken if the city council can be induced to grant the necessary appropriation to pay the city's share of the work at present proposed.

Some twelve or thirteen years ago a committee of the Club studied the question of sewerage and greatly aided the Board of Public Works in its efforts to secure a proper system in the teeth of opposition from those who did not wish to pay their share of the cost.

The general opinion regarding the Commercial Club is that its efforts are entirely disinterested, and its work is as thorough as the circumstances of the case call for. Its recommendations are therefore accepted nearly always as authoritative. It is occasionally accused of putting its nose into other people's business, but not seriously except perhaps by a company whose request for a new franchise is opposed by the Club or by a railroad which does not wish to pay for elevating its tracks. But few citizens know the influence which the club has had upon the appearance, the convenience, the healthfulness of the city, or can guess what the city would have been without the Club's work.

It has been suggested before that the Club is needed because there is still enough politics in the selection of officials to prevent the full development of the business ideal on which the form of government of the city is founded. The political idea extends not alone through the elective officials, where there is some excuse for its existence. Party organizations are not made in a day, and they seem to be a necessary accompaniment of our form of government. They may be used, however, for local purposes on occasions of local elections, provided the voters will put themselves in the proper state of mind to vote for the candidate on the other ticket in the local election when his stand on local questions is more satisfactory. Enough Indianapolis voters are in this condition to throw the election either way they desire. Their only complaint is that the methods of nomination now in vogue often prevent the selection of men satisfactory to the rank and file of the party organization. The political idea also demands the substitution of old employes by new ones at each election, presumably because they are more in sympathy with the new organization. This is the present drag on the development of still more advanced ideas and one of the greatest obstacles to the carrying out of the improvement ideas of a progressive and active business men's association. The application of civil service rules to the fire and police departments of Indianapolis, modified only by the requirement that the number of men in them must be half from each of the principal parties, shows that some method of retaining efficient employes indefinitely after they have been appointed for merit can be successfully applied.

The Merchants' Association of San Francisco has been equally prominent in the agitation of improvements for its city. Starting in 1894 its first work was on the streets of the city. It assumed the contract for street cleaning, and finding the appropriation inadequate, it collected nearly $30,000 additional by voluntary subscriptions. Eight months of this work was sufficient to show what could be done in cleaning streets and the work has since been done under specifications approved by the Association.

The Association interested itself in many things from a directory of the city hall to street paving and made many appropriations and collected many subscriptions in aid of its projects. These things, large and small, seemed to be necessary to produce object lessons that the municipal officials might be taught what could be done and how to do it.

When the time was ripe the Association took up the question of a new city charter, and one was finally worked out in satisfactory form and adopted. The Association then found it necessary to watch almost every step of the process of putting the charter in operation and finds frequent attempts at violation of such provisions as those providing for civil service, the letting of contracts, etc., sufficient to keep it always on the watch. It still finds object lessons necessary, such as a recent "isle of safety" in the midst of a busy street crossing, a public convenience station under a sidewalk adjoining a small city park, etc.

One of the valuable features of this Association's work is a monthly paper containing four or five pages of reports or projects for improvement or development of the city and its industries and a list of the club's members. This is a medium of communication with the members and with the people of the city which is very valuable in an educational way.

San Francisco's Association seems to find necessary considerable detail of work which the Indianapolis Club has been able to neglect. Possibly this is because the political balance is more sensitive in Indianapolis, so that the officials must come nearer to pleasing the people, and because the people take a more personal interest in their municipal housekeeping in Indianapolis. The concentration of power in a single head makes it easier to watch operations and makes it much harder to shift responsibility and thus give opportunity for occurrences which bring benefit to some individuals at the expense of the public purse.

The success of such associations as these is evidence of the growing interest of the public in their forms of local government. While the workers in such clubs often complain of the lack of expression of such interest, it must be noted that any competent person with an idea for the improvement of the city has a hearing and an opportunity to present his project and assistance in carrying it forward. This could hardly happen if public opinion were not moving in the same general direction. On the other hand, a man who is pushing an idea with the purpose of benefiting himself is very likely to be found out and his project fails of development or is transferred to other hands.

Using the simile of the business corporation again, it is ordinarily true that a committee of the stockholders appointed to watch the officers of the company and to make suggestions as to the manner of conducting the business is evidence of friction in the company and the committee is considered to be meddling in matters with which it has only a remote connection.

The Merchants' Association is scarcely this sort of committee. It is made up from both majority and minority stockholders who are entirely without bias when questions of business arise, and they know that the officers whom they have elected do have a pronounced bias for the members of the majority which has elected them. They know that it is more difficult to elect the best business directors under our political system than it is to elect the best directors of a commercial or manufacturing organization, and therefore feel themselves justified in putting themselves on watch. They see also that they cannot get everything they want and should have unless they ask for it with sufficient voice to be heard. So while they are sometimes accused of trying to attend to other people's business, they are really trying to attend to their own and that of the citizens who have learned to trust them, and their interest and even interference is generally justified.

Many municipal officials, especially of the elective class, recognize their limitations and are glad to have the assistance of a body of men, but few of whom could be induced to accept the ordinary municipal offices but are willing to put in a little time giving of their store of knowledge, experience and judgment for the benefit of their elected representatives and thus of their place of residence.

All in all these organizations are a healthful development and their success when conducted on broad lines and good principles is evidence of their desirability. The cities having the most successful organizations are most noted for their material improvement, not referring to increase in mere size. In almost every instance their assistance is gratefully accepted by honest and well meaning officials in the same spirit in which it is rendered.

PRESIDENT BALLARD: There are two committees to be appointed at this session, to report tomorrow morning, a Committee on Location and a Committee on Nominations.

On the Committee on Location I shall appoint Messrs. Eggers, Pollock, Chausse, Brown and Folwell.

On the Committee on Nominations, Messrs. Fisher, Rust, Phillips, Barrow and Sherrerd.

MR. RUST: I should like to have some expression on the necessity of the organizations spoken of in Mr. Brown's paper.

MR. ADAM: In the city of Newark the Board of Trade is made up simply of persons similar to the Indianapolis Commercial Club. They undertake to discuss matters of prominence, such as intercepting sewers, the water supply of Newark, and have undertaken to get a new water supply. They are the chief and principal means of securing these things for the city. We had local improvement societies some years ago. They held their own for a few years, but interest died out. The Board of Trade is constituted of a different class of people. They are representative people of Newark, men of responsibility and great influence. They have a great deal at stake in the management of the city, which the local society members did not have. They are a more intelligent set of people, on the whole, than composed the smaller societies. It is not exactly a local improvement society, but is a Board of Trade whose principal object is to organize the best merchants to further and protect the interests of the city. Anything that furthers the interests of the city will further their interests.

MR. RUST: It seems to me these gentlemen who take upon themselves to discuss municipal matters, which I think are properly left to the members of the council, would do much better if they would sacrifice some of their time and become members of the council. My experience is that those local organizations do very little good. They talk about a lot of things while they do nothing. It appears to me that when men of experience are called in by the councils and given their reports that should be sufficient. Our experience in Toronto is that these organizations are of very little benefit.

MR. FOLWELL: Many of our smaller cities do not call in experts, and the citizens at large know that whatever decisions are arrived at are reached without the help of experts. In that case it is proper for the citizens to say, "if our city fathers do not employ experts to investigate these matters, it is our duty to employ them." If experts have been employed it is only bringing about unnecessary wrangling to employ other experts. However, it is the duty of someone to see that experts are called in.

MR. OWEN: The first movement that assumed any prominence was started by a special committee of the Board of Trade of Newark. Their influence was paramount in getting the project in the shape it is. I think the idea about boards of trade is not properly appreciated. In everything there must be an initiative. Sometimes the initiative is taken by the officials and sometimes they wait for an expression from the people. Where the function of these organizations comes to the front is in knowing what the communities need. Men of business know what their community needs, and they take the initiative. Then after the initiative is taken and progress made the experts should be called in.

PRESIDENT BALLARD: The greatest incentive we have had in the city of Newark to get an expression, as far as public opinion goes, has been from what we call our Board of Trade. Formerly it was like Boards of Trades in other localities, that are assumed to be mutual admiration societies. That is not so now. It is now composed of five or six hundred of the most influential citizens of Newark. While in the past their opinions have not gone for much, they are pretty carefully watched now and followed out in a great many cases. Boards of Trade when properly conducted have been the means of doing as much good as any organizations of citizens anywhere.

Mr. Rust: We have a Board of Trade, and the men composing it thought it would be a good idea to have power from Niagara Falls. They had a meeting with the authorities of some of the neighboring cities. The municipalities thought they wanted an opinion from experts. Toronto will have to pay about twelve thousand dollars for that report, and at the same time we know the municipalities will not go into the work. Private companies have developed it.

Mr. Eggers: Our Board of Trade in Newark usually invites the members of the Board of Works to be present when such questions are discussed. They use good common sense, and there is no politics in the matter. Whenever matters of municipal improvement come up before them they not only invite the Board of Public Works, but invite the engineers of the city to be present and to give their opinions. We all work in harmony, and have not had a scandal in the city of Newark for years past. We have a regular city expert who goes over every department in the city. He is a good, competent man, and he goes over the accounts of all the departments. He does not give notice of his coming, but goes to all departments and goes over the accounts.

Mr. Brown: The Indianapolis Commercial Club is very much like the Newark Board of Trade. The Commercial Club does not interfere with things that are already in good hands, but very largely takes the initiative in those things they think the city ought to do. When the city begins work on anything of that kind the Club drops out. In other words we term them a committee of the stockholders who go on the theory that the carrying out of details should be put in the hands of technical experts. So far as it is necessary to inform themselves so they will know what they are talking about they get expert advice, but when it comes to the point where it needs experts to carry out the plans it is put in their hands.

GEORGE W. TILLSON
Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Secretary, American Society of Municipal Improvements

Mr. Rust: It seems to me the moral of it all is not to have so much politics in municipal matters.

Mr. Reichardt: Improvements have been made in many cities through women's improvement societies. I do not see why the men can not in the same manner take care of the public improvements. Mr. Rust says they ought to get into the council. I know of instances where our best citizens have attempted to get in the council and into other offices, but they were beaten by the other men.

Mr. Sherrerd: There is one thing Mr. Brown did not refer to that shows the advantage of such organizations of citizens, and that is the Harrisburg League of Citizens. They employed experts themselves and got up reports on the development of the town. They got up these reports on the sewerage system, the waterworks system, parks and pavement. As a result of that a special act was passed in the legislature allowing that town to vote on those improvements. The town did vote on the improvements, and they are now under way on a systematic plan. They had been in a very bad way in Harrisburg before, and it had been very difficult to get anything done in a systematic manner.

Mr. Brown: The rebuilding of Baltimore is another example of this.

I should like to make one announcement before adjournment, and that is that on the fair grounds tomorrow is what is called Civic Day. There will be two programmes in the Town Hall on the Model Street. Thursday morning the session will be presided over by John A. Butler, of the Civic Association, and in the afternoon the session will be presided over by Clinton Rogers Woodruff, of the National Municipal League.

On motion of Mr. Sherrerd, the session was then adjourned.

SECOND SESSION.

The second session was called to order at 9:30 A. M., Wednesday, October 5, 1904, President Ballard in the chair.

PRESIDENT BALLARD: The first thing this morning will be the report of the Committee on Nominations.

The following report was read by Mr. Fisher, Chairman of the Committee on Nominations:

REPORT OF THE COMMITTEE ON NOMINATIONS.

Your Committee on Nominations respectfully reports that it has unanimously agreed upon the following nominations for the several offices specified.

President—A. Prescott Folwell, Easton, Pennsylvania.
First Vice-President—C. C. Brown, Indianapolis, Indiana.
Second Vice-President—John R. Barlow, Montreal, Canada.
Third Vice-President—W. B. Howe, Concord, New Hampshire.
Secretary—George W. Tillson, Brooklyn, New York.
Treasurer—F. J. O'Brien, Oswego, New York.
Finance Committee—Alcide Chausse, Montreal, Canada; E. S. Barrow, Hamilton, Canada; A. F. Eggers, Newark, New Jersey.

(Signed) E. A. FISHER,
M. R. SHERRERD,
C. H. RUST,
E. S. BARROW,
GEORGE PHILLIPS,
Committee.

It was moved by Mr. Adam, and seconded, that the report of the committee be received.

Carried.

It was further moved by Mr. Adam, and seconded, that the rules be suspended and that the Secretary be authorized to cast the collective ballot of the Society for the members named in the report for the various offices.

Carried.

For the Committee on Location, Mr. Eggers made the following report:

The committee met this morning and recommends unanimously that Montreal, Canada, be the next meeting place. We recommend to the Executive Committee that the convention be held between the first and fifteenth of September, in 1905, in Montreal, Canada.

On motion, the report of the committee was adopted, and Montreal named as the next meeting place, and that the Executive Committee be authorized to call the meeting between the first and the fifteenth of September.

Treasurer F. J. O'Brien submitted the following report:

REPORT OF THE TREASURER.

OSWEGO, N. Y., Oct. 4, 1904.

Receipts—

Balance Oct. 17, 1904	$193.25
Received from G. W. Tillson, Secretary	459.75
	$653.00

Disbursements—

1903.		
Oct. 21.	G. W. Tillson, Secretary, salary	$100.00
	G. W. Tillson, Secretary, disbursements	40.19
	Chas. H. Rush, President, disbursements	47.93
Dec. 21.	Mary Burke East, stenographer, services	30.00
	Exchange on checks	2.80
	Balance, Oct. 1, 1904	432.08
		$653.00

F. J. O'BRIEN,
Treasurer.

On motion, the report was received and ordered spread upon the minutes.

The Committee on Finance reported as follows:

REPORT OF THE COMMITTEE ON FINANCE.

Your Finance Committee herewith reports that it has examined the accounts of the Treasurer in detail and found them correct.

The balance on hand on October 17, 1904, was $193.25, and the receipts for the year $459.75, making a total of $653.

The total disbursements have been $220.92, leaving a balance on hand October 4, 1904, of $432.08, an increase of $238.83, which must be considered very satisfactory.

The Committee has also examined the accounts of the Secretary, and find that he has received from all sources $459.75, and has paid the same to the Treasurer.

All of which is respectfully submitted.

ALCIDE CHAUSSE,
AUGUSTUS F. EGGERS,
Committee on Finance.

On motion, the report of the Finance Committee was received and ordered spread upon the minutes.

Secretary Tillson read a communication from the International Congress on Tuberculosis, in which the members of the American Society of Municipal Improvements were invited to attend the sessions of the Congress.

On motion, the communication was received and placed on file.

A communication was also received from the Anheuser-Busch Brewing Company inviting the members of the Society to visit their plant.

On motion, the communication was accepted and the Secretary authorized to extend the thanks of the Society to the company for the invitation.

A communication was received from the Tyrolean Alps Company, World's Fair Grounds, asking the members to visit their concession during their stay in St. Louis.

On motion, the invitation was received, and the Secretary authorized to extend the thanks of the Society to the company for it.

PRESIDENT BALLARD: The next paper is by W. H. Broadhurst, of Brooklyn, N. Y., "Municipal Laboratory for Testing Asphalt and Cement." As Mr. Broadhurst is not present the paper will be read by Mr. Pollock, Chairman of the Committee on Street Paving.

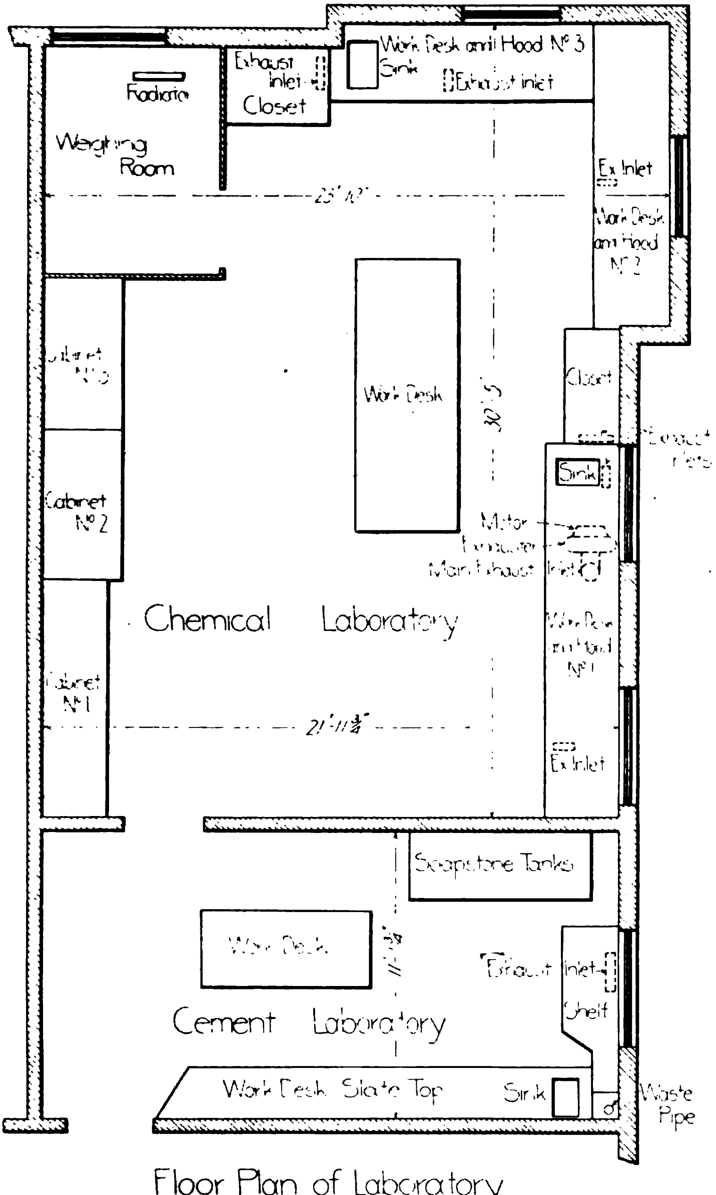
A MUNICIPAL LABORATORY FOR TESTING ASPHALT AND CEMENT.

BY W. H. BROADHURST, CHEMIST, DEPT. PUBLIC WORKS, BROOKLYN, N. Y.

Inquiry is frequently made in regard to the proper construction, equipment, cost and maintenance of a laboratory for testing paving materials, asphalts, cements, etc. Municipal officers, while appreciating the distinct advantages derived by laboratory control of public works, hesitate to establish such a plant without accurate data covering these points. Such data has necessarily been limited. It is therefore the purpose of the writer to describe briefly a plan for a municipal testing laboratory, designed primarily for testing asphalts, asphalt pavements, and hydraulic cements, and incidentally to include facilities for testing any material used on public work. Such a municipal laboratory has been established in Brooklyn, and the details of construction are herewith presented.

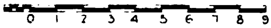
Some two years ago the Department of Public Works of Brooklyn decided to enlarge the laboratory which it had up to that time maintained successfully for about six years, and equip it on a more comprehensive and substantial basis. This change, though much needed previously, was necessitated by the large amount of asphalt paving work planned for the years 1902 and 1903, namely, some 1,300,000 square yards, which was duly contracted for and laid under laboratory control. In planning the construction of the laboratory we were limited only by the amount of space allotted for this purpose. It was our aim therefore to make the details complete in every particular. A corner room 22x40 feet, situated on the top floor of the Municipal Building, and having windows on the east and south sides, was selected as best suited for laboratory purposes. The room was also provided with a skylight, a very desirable adjunct for scientific work. Plans and specifications were prepared for the installation and erection of the necessary fixtures, cabinets, work desks, etc., the relative positions of which are shown on the accompanying diagram. Cement testing necessarily creates considerable dust. Dust is inimical to accuracy in chemical analysis, hence these two classes of work should be separated as completely as possible. The room was therefore divided by a plaster partition wall with connecting door, into a cement laboratory and a chemical laboratory.

The cement laboratory was provided with three briquette immersion tanks, a moist-closet in which to keep briquettes in moist air before placing them in water, a slate-top work-desk running the entire length of one side of the room, and a central work desk, covered with plate glass on which to mould briquettes. A device for carrying off dust, incident to sieving cement, was also provided for. It consists of a galvanized iron hood connected to an exhaust draught by a central flue which will be described later. The briquette immersion tanks above referred to have been especially satisfactory. They consist of three rectangular tanks of 1¼-inch soapstone, 7x2½ ft. x7 in. deep (outside measurement), having



Floor Plan of Laboratory

Scale



a capacity of 800 briquettes each. The tanks are placed one above the other 1 ft. 3 in. apart, supported on a wrought iron frame work. They are each supplied with running water, having a supply pipe at one end and an overflow outlet at the other, the flow of water being regulated independently for each tank by a series of Jenkin's globe valves. The equipment includes a Fairbank's cement tester, a Riehle 2,000-lb. cement tester with worm-gear, and a general run of cement testing apparatus and accessories. Tests for tensile strength, fineness, time of set, and soundness are carried on from day to day, and more occasionally analyses are made of doubtful samples. Ten thousand briquettes were tested in 1902, and twenty-seven thousand briquettes were tested in 1903.

In the chemical laboratory, work desk cabinets, closets and apparatus cabinets were placed along the entire perimeter of the room. Three slate-top work desks, 2 ft. 10 in. in width, each provided with a glass framed hood 7 ft. high, were erected along the south and east walls. The hoods were provided with sliding windows operated by Pullman spring balances to economize space, thus avoiding the cumbersome pulley weights usually used. Each work desk was provided with a slate backing, carrying water, gas and waste pipe connections along its entire length. Sinks, countersunk in the slate top, were provided at the left end of each work desk. At the northeast corner of the room, a space 7x9x10½ ft. high, was partitioned off with glass frame partitions as a weighing room. This room being small, the temperature may be more readily controlled. It is therefore well adapted for use in making penetration tests on samples of asphaltic cement. In the remainder of the space along the north side of the room, three large cabinets were placed. These cabinets are 12 ft. in height and 2 ft. 6 in. in width, divided into upper, middle and lower compartments, and furnished with ample shelving and drawers for storing apparatus and samples. A sliding ladder, attached to a track on the upper part of the cabinets, gives convenient access to each. A large work desk, 10x4 ft., occupies the center of the room.

With the experience gained in previous years we were prepared to install in the chemical laboratory some necessary, though novel, features. The analysis of asphalts and asphalt pavements requires the use of a considerable amount of bisulphide of carbon,—an ill-smelling liquid, which evaporates quickly when exposed to the air, forming a gas which is exceedingly injurious to inhale. This gaseous bisulphide of carbon is also very inflammable, and therefore dangerous to have in proximity to gas burners or gas stoves, commonly employed for heating purposes in chemical operations. We therefore decided, first, to do away with the flames and employ electric heating devices only, and secondly, to remove the vapor of bisulphide of carbon as soon as generated, by a system of artificial ventilation, i. e., by sucking the air continuously from each hood by means of an exhaust fan connected to a central flue, or more properly, a rectangular sheet iron duct, cross section 20x5 in., running beneath the floor under the hooded work desks, connection being made with each hood by valved offsets from the main duct. In this way each hood and work desk is connected with the exhaust, all smoke, fumes, gases and odors generated being quickly removed, and a current of pure air supplied to each hood. The main duct was of course installed before the cabinets were erected. It is to be noted that the windows in proximity to the exhaust outlet are kept closed, the intake of air coming through a ventilator in the roof. A No. 4 Sturdevant exhauster, with bottom horizontal discharge is used on this system, the discharge passing through a circular opening in the wall. The exhauster is operated by a 1 H. P. electric motor, direct-connected, and controlled by a speed-regulating rheostat.

For the electric heating apparatus, four (4) twelve-ampere outlets were provided on a 230-volt circuit, independent of that used for lighting. The outlets were located at convenient points along the wall at the back of the hooded work desks, and were connected with plug-switch receptacles which covered them. The electric heating apparatus was furnished by the Simplex Electric Company, of Cambridgeport, Mass. The electric heating devices installed include three immersion coil steam baths for evaporations, distillations, etc., two flat surface stoves, one electric oven for obtaining constant and uniform temperatures up to 500° Fahrenheit, and one controlling rheostat. Each of these instruments provides for three heats—high, medium and low—and the heat may still further be controlled by throwing a rheostat in circuit. The electric oven is particularly well adapted for the determination of the volatile matter in asphalts and oils, as the heat is radiated from iron plates in which the resistance wires are imbedded, thus insuring a uniform heat throughout the oven—a most desirable condition for this class of work. The use of the electric current has the added advantage that the heat may be more readily controlled than by any other method. The chemical laboratory was equipped with an analytical balance, a balance for heavy weighings, a Bowen penetration machine, a Dow penetration machine, and a general run of chemical glassware and apparatus. If it be desired to adopt the centrifugal method of sedimentation, a centrifugal machine will be required.

The specifications for the construction of the laboratory required all materials to be of the best quality of their several kinds. All woodwork was of clear white pine. The carpentry work, plumbing and sheetiron work was let in one contract to the lowest bidder for $2,745.

The total expense may be itemized as follows:

Carpentry work, plumbing and sheetiron work	$2,745
Electric wiring, switchboard, etc	135
Electric heating apparatus	160
Exhauster, motor and rheostat	165
Cement testing apparatus	600
Chemical apparatus	1,500
Total	$5,305

ASPHALT TESTING LABORATORY, BROOKLYN, N. Y. (First View)

(Second View)

CEMENT TESTING LABORATORY, BROOKLYN, N. Y.

It is to be understood that a laboratory of similar description may be established and operated for very much less than the above figure; but to equip such a plan with every facility, the above figures are correct. The maintenance for the second year was $750, and for the current year we expect this item to be somewhat reduced.

The procedure adopted in the chemical laboratory for controlling asphalt paving work is as follows: Samples of the asphalt mixture are taken from day to day as the material is brought on the street, and tested for percentage of bitumen soluble in bisulphide of carbon, and the percentages of sand and mineral dust retained by a series of sieves of different mesh are regularly determined. The percentage of bitumen soluble in standard naphtha is determined on irregular and defective samples. Penetration tests on samples of asphaltic cement, and complete analyses of samples of refined asphalt flux, and asphaltic cement are made periodically, the samples being taken from the material in current use at the contractor's plant.

Supplemental to the laboratory routine, an important part of the work consists of the inspection of asphalt plants by the chemist. If the analysis shows that any discrepancy exists in the mixture, an immediate inspection of the plant is made to determine and locate the cause of the trouble, the methods of mixing being noted, weights checked and percentages calculated. Even though a correctly proportioned formula has been adopted, a defective mixture may result from such causes as the use of overheated sand, the introduction of sediment from the bottom of the tank into the mixture, the use of damp limestone dust, or from the addition of short weight of asphaltic cement, resulting from the fact that a considerable amount of asphalt cement which has become chilled on standing, due to delay or interruption of the work, clings to the sides of the bucket when dumped. These errors result from carelessness or lack of knowledge and though unintentional as a rule, result nevertheless in producing an irregular composition, which seriously impairs the life of the pavement. The fact that such irregularities occur with the most experienced contractors emphasizes the necessity for frequent analyses and prompt inspection.

PRESIDENT BALLARD: The paper is now open for discussion.

MR. ADAM: I do not think we can discuss the paper, as the author is not here to answer any questions that may be asked. Mr. Broadhurst, I understand, is not a member of this Society. I move that the Secretary be instructed to write to him tendering him the thanks of the Society for his excellent paper.

While not many cities have the money for establishing such a laboratory, there are some who might be able to do it. Although there are other pavements that have been introduced since the asphalt pavements were first laid, I think a large quantity of such pavements will be laid in the near future. I think any city that lays a large quantity of such pavement should have a laboratory for testing. The experience I have had in the city of Newark in having the asphalt materials submitted to the chemist were very satisfactory. Mr. Broadhurst was made the chemist for the city of Newark during the two years in which we laid a large amount of the pavement mentioned.

MR. POLLOCK: The figures Mr. Broadhurst gives are the outside figures that would be needed. All the modern improvements were put in this laboratory. In Brooklyn we have had a greater yardage of asphalt laid in 1902-3 than any city in the country laid in any one or two years. As Mr. Broadhurst states in his paper, these are the outside figures for such a laboratory. No municipality need spend more money than that.

MR. ADAM: It is almost absolutely necessary to have chemical tests made. In the city of New York they are asking only a five-years' guarantee. When Newark was laying pavements the contractors asked a reduction in the guaranty to five years, saying we would probably get cheaper price for the pavements. I said that would do for cities that had an opportunity to make tests before the pavements were laid. By watching closely the material put in the streets and testing it carefully cities can reduce the length of the guarantee.

I move that the Secretary be instructed to write a letter to Mr. Broadhurst tendering him the thanks of this Society for his excellent paper.

The motion was seconded and carried.

MR. REIMER: Some of us who come from little cities you can hardly find on the map realize that laboratories of this kind are out of our reach. I should like to ask whether this laboratory is accessible to the smaller cities? Could we get tests from there for our cities by paying for them?

MR. POLLOCK: I don't believe that could be arranged for. I think Mr. Tillson can tell you about that better than I can. I don't think we have ever done any outside work in that way. When all the contractors are laying asphalt pavements our laboratory has about all it can attend to with our own work. I don't believe it would be possible for the Borough of Brooklyn to go into the work of analyzing samples for other cities.

MR. REIMER: While we have done nothing in the way of brick pavements, every year we seem to be getting a little nearer something of the kind. It would probably not pay us to erect a laboratory to test the small amount of asphalt we will be able to put down in any one year.

MR. FISHER: There are a number of private testing laboratories in the cities of Pittsburg and Washington.

MR. BROWN: There are several colleges that are pretty well fitted for this class of work. They would be very glad to do it. While I can not speak for the laboratory in the city of Indianapolis, I feel quite sure it could be arranged for cities in the state to have tests made by paying for them. That laboratory is well equipped for the ordinary asphalt analysis and for cement testing. Just now they are testing the candle power of our gas. The apparatus for that has recently been added to the equipment of the laboratory.

MR. TILLSON: I think someone asked about the number of men employed in the laboratory.

MR. POLLOCK: We have one chemist. The rest of the help is of a rather cheap class. The chemist supervises the work. The number of people employed varies. I think we have had as many as six or seven employed at one time.

MR. TILLSON: Mr. Broadhurst has one man that helps him in the chemical part of the work. He has two working on the cement tests.

MR. POLLOCK: When there has been a large number of cement samples coming in I think he has had still more assistance in the laboratory.

F. J. O'BRIEN
Street Commissioner, Oswego, N. Y.
Treasurer, American Society of Municipal Improvements

Mr. Tillson: He takes the younger and more intelligent laborers for assistants.

Mr. Pollock: If a city sends samples to a private laboratory they are apt to be delayed in getting the results. You may get your work all done before getting the results. When the material is running along pretty evenly we take one sample a day from each street. If it is at all irregular we take samples as often as once an hour.

Mr. Barrow: In our city the question of what is a working man came up. The street car companies issue tickets for working men and all the people took advantage of them. That has not been decided.

President Ballard: The next paper to be read is "Losses on Underground Municipal Structures," by A. Prescott Folwell, of Easton, Penn.

LOSSES IN UNDERGROUND MUNICIPAL STRUCTURES.

BY A. PRESCOTT FOLWELL.

The author has recently completed the uncovering of some miles of water and gas pipe and replacing the pavement, and while doing so was again forcibly impressed by the enormous loss and inconvenience caused by ordinary municipal and corporate methods of constructing and managing street surface and sub-surface structures. While this is a matter of more or less common knowledge, it is one of the most serious unsolved problems confronting municipal engineers and boards of public works, and it is probably only the apparent hopelessness of remedying present conditions which causes them to be tolerated as they are. The sources of loss are herein considered separately, but possible remedies are considered for all of them taken collectively, for the reason that it seems probable that no remedy can be found for one or two only which will be effective, even for these. In fact, the attempt to treat each by itself is probably the chief reason why no acceptable results have yet been obtained by water, sewer or street boards or commissioners in preventing these wastes; and one of the objects of this paper is to call to the attention of the overseers of each class of improvement the interdependence of them all in this matter, with the hope that by co-operation a common satisfactory solution may be found to all of the difficulties in a considerable number of cases.

Most of the losses to be referred to can be classed under four heads: First. The destruction of street paving by constant digging up of the streets. Second. The cost of the digging itself and replacing the paving whenever the sub-structure must be got at. Third. The losses due to leakage of gas. Fourth. The loss of water by leakage. There are incidentally minor losses and inconveniences, such as the thawing of water mains and service pipes; the interference with traffic caused by excavations; difficulty of access to and ignorance of the exact location of service connections and other appurtenances; the great confusion of pipes so intricately placed beneath the streets of large cities, etc.

I. Pavements. Secretary Tillson, in his work on "Street Pavement and Paving Materials," says: "It is almost impossible to repair any opening in a pavement so that it will be as good as before disturbance," and we all know this to be a fact. It is not that it is not done, but that it is not practicable. The remedy does not lie entirely in being more strict with those disturbing the pavements. No pavement is now in use which can be patched without causing humps or depressions which will diminish the serviceability and hasten wear, and weak spots in the foundation causing after settlements are apt to be numerous. This undoubtedly results in a financial loss both in the pavement and to traffic, the former of which can best be expressed, perhaps, in terms of the shortening of the life of the pavement, but which it is difficult if not impossible to determine definitely. I believe most authorities would admit a reduction of at least 15 to 25 per cent. in the serviceable life of each section patched. The loss to vehicles might be expressed as a negative gain from the improved paving; that is, if the pavement which has been torn up and replaced is but three-fourths as much an improvement on previous conditions as if it had been left intact, then one-fourth the cost of that improvement has been lost. If the pavement were found to last four-fifths as long as if undisturbed and meantime to have but three-fourths its full value as an improvement then the disturbing of that pavement has caused a loss of forty per cent. of its construction cost. The loss to vehicles may not extend over the entire surface when but one or two trenches are dug longitudinally, but the shortening of life does since the pavement must be renewed as a whole and not by patches. (Asphalt can be patched with better success than other pavements, but on the other hand the patching generally costs more.) I believe thirty per cent. of the cost of city pavements would be a conservative estimate of the loss due to disturbing them—50 to 75 cents a square yard, or say $2 to $4 a lineal foot. If this loss be distributed over the life of the pavement and this be assumed at sixteen years (on the basis of twenty years of life if undisturbed) we have 12.5 to 25 cents per year per foot as this loss.

As to the amount of such disturbance. In New York in 1896 one mile in four was torn up for construction purposes, and one opening requiring repairs for every forty feet of paved street. In Brooklyn, during the same year, one opening was made for every 75 feet of paved street.

In Boston, in 1897, in about 500 miles of paved streets, there were 14,017 separate openings, about one to every 185 feet, with a total length of openings of 213.4 miles. In Chicago, in 1902, 20,200 permits were granted to tear up pavements, resulting in about 200,000 square yards of disturbance, or one opening to each 340 feet of street. Records of smaller cities are difficult to obtain, but with the spread of wire conduits and steam heating to small cities and towns (which already have sewers, water works and gas), all agree the destruction of pavements is increasing rather than decreasing.

II. Cost of Digging. This of course depends largely upon the size of hole necessary, but probably no opening costs less than $3 to $5, plus the cost of replacing the paving. This last will cost, if properly done, about as much as the original paving, even when most of the material can be used again—say at least $1.50 per square yard for all pavements on a concrete base, and 50 cents for macadam. In Washington, D. C., the cost of taking up and replacing the paving for street openings during one year, on about 125 miles of streets (100 of which were asphalt and 10 asphalt block) was $47,594.83, or $380 per mile, or 7.25 cents per foot.

Assuming one opening, costing $4 for excavating and backfilling, for each 100 feet of street gives 4 cents per foot for this. Probably 8 to 15 cents a lineal foot of the entire street surface would not be an excessive estimate of the cost of excavating, where the pavement is properly returned.

III. Gas Mains. It has been estimated that "in good practice the normal leakage of gas mains is 225,000 cubic feet per mile per annum for an average diameter of six inches. It is frequently twice that amount; in some instances it is three or four times greater. In American practice leakage ranges from 10 to 30 per cent. of the output." (Jas. C. Bayles, League of American Municipalities, 1902.) In 1898, 353 plants reported to the United States Commissioner of Labor a leakage of 7.3 to 14.7 per cent., 163 of these more than 14 per cent. and all but 26 more than 11 per cent. If we assume that gas costs an average of 40 cents in the mains, and a leakage of 200,000 cubic feet per mile per year, this gives a loss of $80 per year per mile of main, or 1.5 cents per foot. Unfortunately the greatest loss due to leakage of gas does not always fall upon the gas company, but is found in the destruction of asphalt pavements above such leaks; in many fires of "unknown origin" but attributed by insurance companies to gas leaking into cellars and basements from the ground (the freest outlet when street surfaces are sealed with concrete); in explosions and asphyxiation of workmen in sewers, a large part of the "sewer gas" to which this is attributed being generally illuminating gas; and in the illness of individuals and shade trees.

IV. Water Mains. Much has been written about waste of water by consumers; not so much about loss from the underground mains and service connections. Mr. Dexter Brackett reported to the Metropolitan Water Board (Boston and vicinity) in 1904 that "the tests which have been made in the several municipalities of the Metropolitan District tend to show that the leakage from the street mains and services is very large, and that from 10,000 to 15,000 gallons per mile of street main escape each day into the ground or into some underground channel." In one town of this district 24,000 gallons per day was found to leak from 1,000 feet of main—a rate of 130,000 gallons per mile. Different authorities consider that an average of from 500 to 3,000 gallons of water leak from each mile of well laid main daily. Taking the average of poorly laid and well laid, probably 5,000 gallons is well under the actual amount in the average plant. At five cents per 1,000 gallons as the average cost of putting water into the mains this means a loss of $91 per year per mile of pipe, or 1.7 cents per foot.

For the sake of brevity few data have been introduced to substantiate the above statements and assumptions, but they are all based upon reliable reports and investigations, and probably any member of this Society could find in his own city indications if not proofs that they are conservative.

These four losses as estimated above total 22.5 to 45 cents per lineal foot of street per year. This is of course a general average and some cities may be so fortunate as to suffer much less loss. But the author believes there are more in which these figures are exceeded in the business sections. There are the additional considerations of the annoyance from tearing up of streets and from odors of gas, and objections to water waste other than financial ones, and others previously mentioned.

The correction of each of these objectionable conditions without a radical change of the entire system of underground structures has probably progressed nearly as far as is practicable; but with more care joints of sewer, water and gas pipes, and the house services of each (in which much if not most of the leakage frequently is found) can be improved upon. For instance, a small box might be placed over every corporation cock, and goose necks always used; tarred pipe could be rigidly excluded from gas mains (the author has seen a great many tarred specials used in these). Also service connections could be run to the curb opposite every building lot from sewer, gas, water and heat mains just previous to repaving and at no other time. But there would still remain the tearing up of streets for laying new mains, for repairing leaks, thawing frozen pipes, etc.

The most serious loss, that in connection with the paving, can be somewhat lessened by having all tearing up, backfilling and repaving done by the city, at a fixed price which the corporations desiring the excavation should pay. It would not then be necessary to bring pressure upon and await the delays of the corporations responsible for remedying the faulty relaying of a pavement, but all paving and repairs would be under the immediate supervision of and attended to directly by one city department. This is probably the best solution of an undesirable state of affairs, and has been adopted by several cities. But even this does not give perfect repaving, since such is practically impossible, nor do away with the annoyance and cost.

The only solution which can be accepted as satisfactory will be one in which the paving will never need to be torn up until worn out; in which all pipes, wires, etc., can be laid without interfering with the paving and be readily inspected at any time, this being true of service pipes and wires as well as mains. The paving can be preserved by not permitting either private corporations or city departments to lay any mains under the streets, but compel them to purchase right of way along private property, or else reserve strips of public property—such as alleys or strips between the sidewalk and the street (the latter of which would be interfered with by shade trees)—under which all such would be laid. But the other disadvantages are not remedied in this way. To meet them all a general conduit seems to be the only solution, with small branch conduits for the service lines. It seems probable that the Model City of the future will have such conduits throughout its business section at least, where pavements are most expensive and such structures most numerous. In them would be placed the small sewers of the separate system, water, gas and steam-heating mains, while in the walls of hollow tile could be run the telegraph, telephone and other wires. St. Paul already has something similar to this in its sandstone tunnels, as has Paris in its sewers. Nottingham and St. Helens, England, comparatively small cities, have had such conduits for several years. In Chicago 60 miles of tunnels for wires have been built, the trunk tunnels 12⅔x14 feet, the branches 6.5x7 feet. If a private company can do this for its own wires only, it would seem to be still more practicable financially when all the above can be provided for. The advantage of such a conduit is not confined to the *annual* savings if the structures it contains can be originally laid in it, thus saving the excavating and repaving which would otherwise be necessary. This would amount to not less than 75 cents a foot for each structure, or $3 a foot for four—as sewer, water, gas and steam. (In the centers of the larger cities the number of various pipes, etc., would be several times this.) An electrical conduit in a business section costs $2 to $4 a foot or more (26 cents per duct foot on an average). Therefore even in a city of small size—say 25,000 to 50,000—the saving of $5 to $10 on construction would be effected. The loss of 22.5 to 45 cents per foot capitalized at 4 per cent. would give $5.56 to $11.25 per foot, or a total of say $10.50 to $21.00 per foot. The conduit offers other advantages besides these financial ones; such as facility of inspection of all pipes, etc., and exact knowledge of the location and condition of each service connection. Also freedom from freezing of water mains, and ease of thawing if frozen.

The weak point in this argument, and probably one of the principal reasons why more cities have not built these conduits, is that before they are really necessary several of the pipes have already been laid in different parts of the street, and instead of saving much of the cost of laying, the use of the conduit requires the relaying of all of them, or of all but one, around which one the conduit may be built. But in spite of this it would seem as though some such a contrivance is a necessity if we are to construct and maintain good paving; and that the time is coming when any city which can afford a brick, asphalt or modern wood-block pavement must afford to first place under it a conduit which will preserve it from premature disfigurement, deterioration and renewal.

MR. SHERRERD: I would like to speak on the question of water main leakage. I think this leakage is supposed to be from the joints. My experience has been that most of the leakage is due to leakage of some surfaces that have been abandoned, rather than to leakage of joints. The amount of leakage is very much higher in cities like New York that have large water fronts. Inaccuracies of measurement of the entire quantity of water supplied to the city will account for some of the reports of leakage. In most of the cities the different structures, such as gas and water mains, are laid by companies or by the city, but the sewers and pavements are generally laid by assessments. It would require some radical changes in legislation to be able to construct one system of conduits but that would be the best way to do. If such a system of conduits could be built under city management, and the city receive the rental for the space occupied, it might settle the question.

MR. BARROWS: I came across a case lately where water was leaking away without being discovered. We were replacing a 6-inch pipe with a 12-inch pipe and came across a valve at a point where the road had been graded. The pipe was closer to the surface than it should have been and the valve had frozen. There was considerable leakage which did not come to the surface but passed away through the soil, probably through the sewer near at hand.

MR. FOLWELL: I think I stated that in many cases the majority of the leakage is from the surface connections. I have been recovering a large surface of street pavements, and have been replacing a 6-inch main with a 12-inch main. There was a gas main on one side, and we had it under our nose all the time. We found that most of the leakage came from corporation cocks, not from old and abandoned ones, but ones recently laid. They had been improperly put in and were leaking. We must look for a large part of our leaks in corporation cocks and in abandoned cocks. There are some pretty examples of the old abandoned cocks over in the New York building in the Model Street.

MR. F. J. KUMMER: Do your figures include repairs made on the streets during the maintenance period? My experience is that such openings are usually paid for by the corporations and are not paid for by the city.

MR. FOLWELL: In the end the citizens pay for it all. If the city mains are owned by a company the people who use the water pay for all of it. I consider it in the broad light of the loss, not who is losing it.

MR. ADAM: Mr. Kummer spoke especially of the cuts or openings made in the pavements. Did you include that in the loss to the city or to the corporations?

MR. FOLWELL: I took from these figures a sort of rough estimate of about how many openings there were in the streets, and then made an estimate of what they would cost, whether to private corporations or to the city. Whoever did it, there were so many openings made and at such a cost.

MR. ADAM: Mr. Sherrerd thought it would require a radical change in the method of making assessments if a general receptacle was made for all these improvements. The maintenance of pavements is always met by the city at large. I am sorry the City of Newark, at the time it commenced giving the franchise to these corporations, did not take up the matter of providing for a conduit, as other cities have done. It is only about five or six years since they commenced laying the different telegraph and telephone wires under ground. Our main streets are now pretty thoroughly honeycombed. I think where cities have not advanced too far it would be well for them to take immediate steps to lay a conduit for the reception of these pipes. It seems to me it will stop the waste of money spoken of in the paper.

There is another item of expense that is not alluded to. The corporations especially employ Italians or any kind of cheap labor to lay pavements. They will take granite block and cut them up in all sorts of shapes. They seem to have no idea of the value of a stone block. They never get the same number of blocks back, because some are invariably taken away. Those that have been mutilated and broken are wasted. A great deal of money is wasted in this way. I have seen as many as ten or twelve blocks at the side of the street that were not put back. They were not even removed from the street. It certainly is discouraging for a city to lay improved pavements and then have them continually ripped up. In our main street, where most of our business is conducted, the pavement is practically useless and worn out. It is hardly practical to use it any more. A couple of years ago when the traction company wanted to put in new rails I advocated renewing that pavement, but the taxpayers thought they could not afford the expense. The object of this Society is to bring these matters before the public and disseminate a knowledge of them as much as we can. We are also to agitate as much as we can until such things are remedied.

MR. POLLOCK: In regard to the suggestion of builidng conduits in order to carry all the sub-surface structures, I wish to say that some years ago New York attempted this, but they had no law placing the authority in one body to look after it. The water department declined to put their mains in a conduit unless they had absolute control. Then the telephone company would not go into the conduit if the Edison Company went in. Although the rapid transit company was to pay for it the project was abandoned.

MR. TILLSON: I do not understand whether or not the loss to traffic by reason of obstructions is included.

MR. FOLWELL: No; the inconvenience was simply mentioned. No cost was set for that.

MR. TILLSON: That is something that has been brought very forcibly to my mind this year on account of the destruction of the pavements before they wear out. Brooklyn, as a great many of you know, has had the reputation, and deservedly, of being the worst paved city in the country. As a Borough it is rapidly becoming one of the best paved cities in the country. It actually almost makes me sick to see the new and recently laid pavement being torn up to allow the laying of telephone and other wires. During this summer the water contractors alone must have laid in the Borough of Brooklyn from seventy to eighty miles of pipes. A great deal of it has been under pavements that have been laid only a year. The department of water supply is outside the jurisdiction of the Borough president. There is nothing to prevent the water department from going in and paying a main six months, or six weeks, or six hours after our pavements are laid. The Borough presidents, who are held responsible for the condition of the streets, are considered at fault because material from these trenches is left on the streets a long time and the streets torn up, when they have absolutely no control over the contractors. The Borough president is constantly receiving complaints of things caused wholly by the contractors of the water supply department, even though he has no control over that department whatever.

I remember one street, the first one paved with concrete. I was anxious to get a good job on that street, and stayed away from my vacation in the summer in order to see that pavement laid. That was in 1895, and today there is hardly any of that pavement that has not been torn up and put back. If it had not been disturbed it would be practically as good today as when it was laid. You cannot replace a street and make it as good as it was in the first place.

It does seem as though the only solution of this is the use of conduits. If a city will plan for the use of conduits from the beginning it will be a comparatively simple problem. Then the use of the conduits might be put under the control of the city and they could be built by the city. When franchises were given they could be given with the condition that the companies must use these conduits and pay a rental to the city for their use. The great objection to doing that now is because they have already been constructed and it would be difficult to pass a law—and it is a question whether it would be equitable if legal—to compel the different companies to use the conduits. In New York there would be great physical objection to it because so many of the streets there now are so full of these different conduits it would make it necessary to go very deep in order to construct the work without interfering with the surface while the work was going on, and thus make it very expensive. I don't see any other possible way of getting rid of it, however.

Some allusion has been made to the number of cuts being made in pavements. Our openings for the present year have probably averaged from forty to fifty cuts per week in the asphalt pavement. I imagine the cuts in the stone pavements average as high as 125 a week. I have thought of the matter a great deal, and have come to the conclusion that cuts have more to do with the life of the pavement than any other one thing. To anyone who has any real feeling for the work and who wants to keep the streets in good condition, it is extremely wearing to see these openings made. The use of the street does not begin to compare with it as far as damage is concerned. I don't see any satisfactory solution. Even if the pavement has just been laid people will come to you and say there is a tenement house of four or five stories on the street and they cannot get the water above the second story, and you have to let them cut the pavement. You ask them why they did not do this before the new pavement was laid, and they will tell you it was all right then. Many of those services have been laid for forty or fifty years.

MR. EGGERS: In our city the water mains, street pavements and sewers are under the control of the board of works. If a street is to be paved we make it a point to see that all the water mains are put in position; that the sewers are built, and in streets where there are old pipes that may be full of leaks or not laid deep enough originally, we have them relaid. We have spent thousands and thousands of dollars lowering water mains in streets that were being paved for the first time. The water company has also spent thousands of dollars lowering the mains and making new connections.

MR. TILLSON: Can you compel the gas company to do anything?

Mr. Eggers: No, sir; that is beyond our control. They tear up any street without giving us notice of it. That is done under the authority of the legislature.

Mr. Sherrerd: I don't think we are prepared to accept the general conduit as a solution of the question. I think the members who have spoken of that have spoken almost entirely from the point of view of the preservation of the pavements. To build such a conduit would bankrupt a small town. They cannot go on with underground construction in that broad method. I grant it would be a good thing to do, but there are conditions where the conduits would not fill the bill and would not protect the pavements, and each individual case perhaps would need to be considered from the point of view of water distribution. It would be much more economical, I think, to lay the distributing pipes on each side of the street. If the sidewalk is wide enough lay them under the sidewalk. Where streets are over forty feet wide, I think it would be well to have a small distributing main on each side of the street.

When you have your subway, in order to keep from tearing up the pavement for renewals, you will have to have a branch subway from the main subway into each lot. When you add that to the cost of your main conduit you are going to load your city down with a very heavy fixed charge, and it would get to the point where it would be a fine proposition as to the relative cost of those conduits and the cost of a new pavement.

Mr. Tillson: There is no reason why the subway cannot be put under the sidewalks instead of under the streets. However, I don't think you would have room under the sidewalks for all of the construction.

Referring to what Mr. Eggers said, our work, or a very great proportion of it, is repaving streets that have been paved all the way from thirty years to fifty years, where the service pipes have nearly all been laid and they do not know they are in bad condition. The gas companies go in in advance of us always now and dig down to every joint in their mains and calk them and see that they are in good condition. It is the connections and the new mains that are being laid by the water company at the present time.

Mr. Eggers: It would be better if the city had control of all the water supply.

Mr. Tillson: The mayor has control over the water supply department and the Borough President over the streets.

Mr. Adam: You state that the gas company digs down to every joint. How does this disturbance affect the pavement that has been laid?

Mr. Tillson: We very seldom have any settlements there. They are pretty careful.

Mr. Reimer: The human factor undoubtedly has a good deal to do with all of these things. To get men who will stand over a piece of work and see that it is properly done would solve some of these difficulties. I am loath to believe that a ditch cannot be refilled and the pavement put down as good as it originally was. I have seen it done the same as I have seen some tight-joint sewers. It is utterly useless to say to men, "You are doing your work here by the day and I don't care how long you are at it so it is done well," for the ordinary man will slight his work. The difficulty of having a foreman stand over two or three men who are opening a ditch will make a large cost, but I think it would be economy in the end. I know we have had miles of ditches put down where a corporation has had the tearing up of the streets and the repairing of them, and they have done it so well that months after, when all the rains had past and the winter season was over, there was nothing to show that a ditch had ever been opened. I feel satisfied it can be done, but we have got to make allowance for the human factor, and if we will do that we will overcome a great deal of the trouble we have been complaining of.

Mr. Kummer: I was going to say in that connection that it strikes me there is a very important suggestion in the paper that has not been spoken of. The suggestion is that the city should make the repairs in the pavements instead of allowing the contractors to do it. In Brooklyn I know Mr. Tillson has done that. In Manhattan we laid a portion of one street last year and some more this year. Although that pavement has only been completed since April there have been eighteen cuts made in it since that time. There is very heavy travel on that street, and an obstruction to traffic is a very serious matter. When cuts have been made we are obliged to go in there on Sunday when the traffic is light, and on Monday morning when the traffic begins the concrete is not set and the pavement settles. We cannot close the street, but have to go in and make the repairs over again. We cannot even put any barricades about the repairs. If the city made the repairs they might be able to find a way to keep the traffic off long enough to allow the concrete to set. We have not been able to find a way to do it.

President Ballard: The next paper will be by Mr. F. J. Kummer, of New York, on "The Testing of Wood Paving Blocks."

Mr. Kummer: Before reading the paper I shall have to apologize for its brevity. I was not informed until a short time ago that I was expected to prepare a paper. For that reason I was not able to prepare one of greater length. However, something may be brought out in the discussion of this paper that may be interesting.

NOTES ON TESTS FOR WOOD PAVING BLOCK.

BY F. A. KUMMER, OF NEW YORK.

The question of tests for wood paving block is one which is comparatively new to municipal officials owing to the fact that pavements of this class have not until very recently been extensively used in this country. Their use has, however, increased so largely during the past few years that the question is one demanding attention. Numbers of streets have been paved with blocks manufactured from excellent material, carefully treated and laid, which has given such satisfactory results that those interested in city paving are naturally inclined to predicate the success of such pavements in the future upon their undoubted success in the past; but it should not be lost sight of that the great prejudice which has existed against wood pavements in this country during the past twenty years arose from the use of blocks of poor material, improperly treated and laid, and there is exactly that danger existing as a possibility today, namely, that municipalities may lay with every confidence in their probable life, blocks for street paving purposes which are not made either of suitable material or properly treated. To avoid this we must have some means of distinguishing between good blocks and bad blocks, between blocks which are certain to repeat the experience shown by satisfactory service tests or blocks which may fail to do so. This is of course more likely to be the case as the increase of the use of this form of material naturally induces numbers of persons to go into the business, who, either because of lack of experience and knowledge in making such blocks or lack of honest intentions in manufacturing them, may successfully secure municipal contracts for large amounts of work with material which may not in any way justify expectations. This difficulty cannot be overcome by dealing with those companies whose records show their ability and willingness to turn out good material, because of the system of competitive bidding, but as a manufacturer of blocks of this character, the writer unhesitatingly maintains that the more accurate the tests, for determining those qualities in paving blocks which are most desirable to insure successful results, the better the effect upon the industry at large and the more satisfactory to those sincerely endeavoring to turn out first class material. For these reasons it has suggested itself to the writer that some uniform specification and some standard method of testing should be adopted, which will fairly bring out those qualities in paving blocks which are most desirable and which will eliminate, so far as can be done, inferior grades of material.

These following notes are merely for the purpose of suggesting some of the lines to be followed. The writer, as a member of the Committee on Standard Tests for Road Materials, of the American Society for Testing Materials, hopes to be able to render some assistance later, in the matter of formulating standard tests for wood paving block.

In approaching this question it should perhaps be borne in mind that as a rule there is not much individual difference in paving blocks treated by any particular method; that is to say, provided a standard quality of lumber is called for, it is not possible for the manufacturer to make any considerable variation between one block and another. They are unlike, let us say vitrified paving brick, in this respect, where bricks from one portion of the kiln are hard and from another portion soft and where the question of inspection and culling determines the quality of the material and where even a single carload may vary fifty or one hundred per cent. within itself. Wood paving block, when treated, must through the nature of the treatment itself, be all treated alike in any one individual charge, and these charges usually run from three to four hundred square yards of pavement at a time, so that it is not so much a question of distinguishing between individual blocks as to which is good and which is bad, but more a question of determining whether the particular process to which the block are subjected is a desirable process and whether it is being carried out.

The question of determining the quality of lumber of which block are made can be done at the plant when the block are being manufactured, or can fairly well be done after the block are received on the work and this is a matter of simple inspection which need not be dwelt upon here. The question also of whether the treatment is carried out to the requirements of the specifications may also be readily determined by inspection at the plant, or more easily in the case of specifications requiring complete impregnation of the wood, by the simple expedient of either splitting individual blocks open to see whether the treatment extends to the heart, or by placing them in water to determine whether they will sink or float, it being a well known fact that blocks thoroughly treated throughout with creosote or a creosote mixture will sink in water. If half a dozen samples from different parts of a boat or car load pass this test, it is practically certain that the cargo as a whole is equally well treated. It remains therefore, to determine by some form of tests which can be conducted in the laboratory whether the blocks, either samples or specimens taken from those shipped to the work, are in accordance with the specifications, and this brings us to the question of what the specifications themselves should be. The following specifications for wood paving block is one prepared by our Honorable Secretary, Mr. George W. Tillson, for work of this class in the Borough of Brooklyn, City of New York, the provisions of which follow:

1. The wearing surface shall be composed of long leaf, all heart, yellow pine blocks, treated as hereinafter described. All blocks shall be of sound timber, free from bark, sapwood, loose or rotten knots, or other defects which shall be detrimental to the life of the block or interfere with its laying. No second-growth timber will be allowed.

2. The blocks are to be treated throughout with an antiseptic and waterproof mixture, at least 50 per cent. of which shall be dead oil of coal tar, commonly known as creosote oil. The remainder to be resin or some other similar and suitable waterproof material. All portions of each individual block shall be thoroughly treated with the mixture, and after treatment the specific gravity of the blocks shall be greater than that of water.

3. After treatment the blocks shall show such waterproof qualities that, after being dried in an oven at a temperature of 100 degrees for a period of twenty-four hours, weighed, and then immersed in clear water for a period of twenty-four hours and weighed, the gain in weight shall not be greater than 3 per cent.

Taking up these specifications in detail, you will see that the first clause refers to the quality of the lumber, a matter which can be determined, as before stated, by careful inspection.

The second clause deals with the nature of the treatment itself. The writer has seen specifications in which at least a page of typewritten matter is devoted to the tests which the creosote oil to be used in treating blocks shall pass. As a matter of fact, it is perfectly well known to all manufacturers of treated timber that the amount of antiseptic material contained in ordinary dead oil of coal tar is sufficient to prevent decay of the wood if diffused throughout its mass, provided the oil is retained in the wood in its full strength and efficiency. In other words, it is useless to specify tests for the creosote oil used if the only result desired is a good specification. In fact, there is such a wide diversity of opinion as to the value of different creosote oils, that there is really no settled practice today as to the exact analysis of such oils. The state railroads of Germany originally used oils containing a high percentage of napthaline, the supposed chief function of which is to solidify in the pores of the wood and prevent the evaporation of the tar acids and other more antiseptic parts of the compound. Some years ago the practice of the German distillers of coal tar changed and they began to produce an oil containing very little napthaline, owing to the sudden extensive use of the latter in the manufacture of artificial indigo. About that time the manufacturer, who treated practically all the ties for the state railroads, gave a dinner to the railway officials and announced, as a result of a series of tests, that oils with very little naphthaline and a very high percentage of tar acids, carbolates, etc., were the most desirable for wood preserving purposes, whereupon the state specifications were changed, and such has been the practice of the German state railroads since then. This practice prevails because it is that character of oil which the German distilling works principally produce and for no other reason. The United States government on the other hand, has always insisted upon high percentages of napthaline, as is the practice in England, but it has not been found to be the case that the results with timber treated by the two different methods are very different, although the writer believes that where straight creosote is used the napthaline is a desirable ingredient. The exact action of creosote oil in preserving wood is not understood. All that we know is that commercial creosote oils have been used for many years with almost uniformily good results whatever the character of the oil under analysis. This little digression with reference to creosote oils is intended merely to show the uselessness of specifying any exact analysis for the creosote oil itself. Its analysis will depend very largely upon the particular works from which it comes, some oils running 40 per cent. in napthaline, some as low as 20 and lower, and others between the two, but all of these oils, as before stated, are sufficiently antiseptic in their nature to prevent decay in wood if they are properly retained in it. For this reason the Brooklyn specification does not provide any tests for the creosote oil itself, said oil being a staple article of commerce which has been used for timber treating purposes for over sixty years with uniform success. The strong point of the specification quoted above is its demand for results, and to secure these a manufacturer is required to incorporate with his creosote oil some waterproof material which will perform the double purpose of retaining the creosote oil in the wood and of keeping the water out. As soon as a block begins to absorb water, not only is it in danger of swelling and destroying the surface of the pavement, but by becoming soft and spongy, wears much more rapidly than a block which is waterproof. The very simple expedient is therefore adopted of making an absorption test, the limits of same being 3 per cent. after 24 hours drying and 24 hours soaking in water, a limit smaller than that generally adopted with vitrified brick, and one which means practically no absorption at all. The writer is informed that tests conducted on such blocks in the Borough of Brooklyn last year showed an absorption of less than 1 per cent., these blocks being taken from the blocks delivered on the street and being fairly representative of the quality of the shipment.

It should be noted from the specifications quoted above that it is not incumbent upon the manufacturer to use any particular amount of waterproof material in his treatment. The specifications say at least 50 per cent. of the mixture shall be dead oil of coal tar, but the manufacturer might make this 60 per cent. or 70 per cent., or more, but if he does, he will be constantly decreasing the waterproof qualities of his blocks, and getting consequently higher absorptions. Blocks treated with ordinary straight creosote oil alone will absorb from 8 to 12 per cent. of water and it is a point of excellence of these specifications that they call for results and not methods, it being a perfectly clear and well known fact that the exclusion of water is the main object and not how it is done.

Singling out the four important requirements of this specification, which can be determined by inspection or physical tests, we have first the quality of the lumber; second, the question of the absorption of water; third, the treatment throughout of the block; and fourth, its specific gravity, roughly determined by the ability of the blocks to sink or float in water. These four physical tests cover almost all, but not quite the entire ground. There is one important item in the manufacture of a first class paving block which is not covered by them and that is the question of the hardening of the wood. Let us suppose for instance that one block is treated with a mixture of creosote oil and rosin and shows the required waterproof qualities, depth of penetration, specific gravity, etc. The engineer who has passed such a block knows that the quality of his wood is all right; that the block contains a waterproof and antiseptic mixture which practically prevents the absorption of moisture, and that the block is treated throughout with the preservative material. Experience in the past has shown him that this block will wear well, will not decay, and that the compound with which it is treated does not deteriorate or escape from the wood. On the other hand, let us suppose that a manufacturer were to produce a block treated with a mixture of dead oil of coal tar and some such waterproof material as paraffine or bitumen. It is possible that these blocks also would pass the above specification because the waterproof qualities of a mixture of dead oil and bitumen, let us say, thoroughly forced into the wood would doubtless be sufficiently great immediately after treatment to repel the introduction of moisture, but considerable difference would exist between the two blocks nevertheless. The first block would be a great deal harder than the original wood because the solidification of the rosin in the pores of the wood has been shown by actual tests extending over years to very materially harden the fiber of the wood and increase its resistance to abrasion, and this is a very important requirement in paving block, especially where it is subjected to heavy travel. Some other waterproofing material such as those mentioned above might be used, which, while giving the necessary exclusion of water, would not harden the wood at all and therefore there would exist between the two blocks a very material difference in their ability to stand heavy traffic. We are therefore brought to the question whether in the case of wood block, as in the case of vitrified brick, some form of abrasion test cannot be utilized which will determine the hardness of the material as well as its resistance to moisture. The ordinary rattler test for brick would be be valueless in such a case, if for no other reason because the two faces of the block are the only portions of it which are calculated to stand heavy wear, the four sides being totally deficient in this respect because the fibers of the wood are not presented at right angles to the action of travel. The writer read a paper before the American Society for Testing Materials on this subject at their Annual Convention in Atlantic City last June, and a series of tests were suggested which might record the amount of pressure required to force a die of a given size into the end fibers of the wood for a constant depth, the block being tightly held in place on all sides by suitable clamps, but as yet no results of testing by this method have been secured. At this convention it was suggested to the writer by Mr. Logan W. Page, Chief, Division of Tests, Bureau of Chemistry, Washington, D. C., that a series of tests might be conducted upon paving blocks by means of the Dore machine, now installed in the laboratory for testing road materials at Washington, which machine consists roughly of a horizontal plate revolving against the face of the block to be tested under given pressure, sand being fed upon the plate so as to produce a regular and uniform abrasion of the surface of the test piece. The writer is having tested by Mr. Page some blocks treated with straight creosote alone and with a mixture of creosote and rosin; also some untreated blocks, and the results of these tests he had hoped to present herewith, but a telegram received from Mr. Page, dated September 27th, and reading, "Machinery broken down. Cannot send results at present," makes it impossible. For purposes of comparison only, and with no hope of securing results having any absolute, but merely relative values, the writer has had a series of rattler tests made with the following results:

Six blocks of each kind were tested, the size in each case being 3x3½x8. Tests were made upon untreated Georgia pine block, block treated with creosote oil and block treated by the creoresinate process. The rattler used was a 36-inch foundry rattler, four feet long, and one hundred pounds of iron castings were placed inside along with six blocks. The rattler was revolved at about 15 revolutions per minute for two hours in each instance. Results were as follows:

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Untreated blocks—	
Weight of 6 blocks before testing	12 ℔. 2 oz.
Weight of 6 blocks after testing	11 ℔. 11 oz.
Loss	7 oz.
	4 8/10%
Creosoted blocks—	
Weight of 6 blocks before testing	16 ℔. 1 oz.
Weight of 6 blocks after testing	15 ℔. 11 oz.
Loss	6 oz.
	3 1/10%
Creo-resinate blocks—	
Weight of 6 blocks before testing	17 ℔. 15 oz.
Weight of 6 blocks after testing	17 ℔. 9½ oz.
Loss	5½ oz.
	2 5/10%

The writer does not believe that these tests have any particular value except as indicating a certain relation between untreated and treated blocks. It would be impossible to recommend the rattler test for paving blocks as a method of testing. The writer hopes that the result upon the Dore machine in Washington will be more conclusive and that before the Society meets again some means will have been arrived at for determining the relative resistance of blocks treated in different ways not only to moisture but also their relative resistance to abrasion. Such a determination will, it is believed, ultimately become necessary in any comprehensive system of testing paving blocks.

Mr. Reimer: I should like to ask if the test provides that the blocks shall sink in water after having been treated? Will not the pine sink in water without being thus treated?

Mr. Kummer: My experience is that dry yellow pine will not sink in water without being treated.

Mr. Reimer: Years ago my father brought from Florida some yellow pine timber and we had no difficulty in letting it sink. I wondered whether these blocks were from the same class of material. This was a very heavy pitch-pine, and perhaps the amount of pitch in it caused it to sink.

Mr. Kummer: There is a class of wood in the South they call "light wood," because it is very fat. I have seen that wood in the shape of tombstones that had been up for seventy years and had not decayed a bit. Of course it is almost solid resin and will sink. The pine I speak of will not sink without being treated. The moisture is taken out of this wood before it is treated for blocks, and this is supplied by the mixture the blocks are treated with.

Mr. Folwell: It has occured to me to wonder whether Mr. Kummer has considered the way the blocks are fastened in the inside of the rattler. I suppose a great deal of objection to the rattler test is because of the tearing of the fibers.

Mr. Kummer: I think perhaps the Jones rattler would be better than the Dore machine. I did not know that any of these rattlers were in use. I have not heard of their being used.

Mr. Brown: I think there are only a few of them in use.

Mr. Eggers: What is the oldest pavement you have laid with those blocks?

Mr. Kummer: The oldest is on Tremont street in Boston. That has been down four and one-half years. Last month we took some of the blocks out of that street. We measured them after they were taken out and found they were worn evenly. The greatest reduction was three-sixteenths of an inch. We took up a whole hill on Tremont street. Afterwards we laid the same blocks again with a quarter-inch cement joint to make a groove.

Mr. Tillson: You stated that in making the tests, or rather in inspecting the blocks, if half a dozen blocks were taken from a car and they were satisfactory it would be fair to presume the whole car was satisfactory. Suppose four of that half dozen were found defective, would not that be reason enough for refusing to take the car?

Mr. Kummer: I think it would.

Mr. Brown: What would you do with brick? Would you average the results?

Mr. Tillson: We would have to do that. We would take a certain number, and if they failed to come up to the requirements, we would have to reject the lot.

Mr. Brown: You know in Indianapolis they lay the blocks diagonally. That gives a very good opportunity to observe whether the blocks wear evenly or not.

Mr. Tillson: As I understand Mr. Kummer, he said a block treated with creosote alone would absorb eight or ten per cent.

Mr. Kummer: I don't think by treating with creosote alone you will get a block that will absorb less than that

Mr. Tillson: Are you acquainted with the specifications for wood paving in Baltimore?

Mr. Kummer: I am.

Mr. Tillson: My impression is that on their creosote blocks they call for them to absorb not more than three per cent. in the simple creosote treatment.

Mr. Kummer: That is true.

Mr. Tillson: I know they have laid pavements with that block.

Mr. Kummer: That is also true. I do not know what the results of their tests were. I know we have tried it frequently and could not get blocks to absorb less than five per cent. Probably Mr. Brown knows about this and can give us some information.

Mr. Brown: The city of Indianapolis has a great deal of block pavement. Quite a number of experiments have been made there. They have a specification which has been pretty carefully drawnwith reference to getting a block as impervious as possible. It is hardly proper to say the tests were made with ordinary creosote oil, because they have found it necessary to draw a specification which will make the oil more uniform than that which is usually found on the market. As Mr. Kummer has stated, the oil produced at different factories differs in quality. They are more or less soluble in water. It is possible to prepare creosote oil in such a way that it will be approximately insoluble in water, and approximately will not evaporate, and to put it into blocks. The result of the test of our blocks is very good. Those are not exactly ordinary creosoted blocks. They are supposed to be more waterproof. My recollection is that the tests showed something below three per cent.; somewhere in the neighborhood of two per cent.

Mr. Adam: In the matter of the condemnation of blocks, in Newark recently the paving brick were tested and all looked very good. Judging by appearances they were good. They used the breaking test and the absorption, but of twenty-six samples that were sent to be tested, a large per cent. did not meet the requirements of the specifications and the contractor was ordered to cull the brick. Then a test was made of those he considered as meeting the requirements of the specifications. Ten per cent. of those failed to come up to the standard. I recommended to the board that they let those that were culled go in and when rain fell on the brick it would be seen where brick would not stand the absorption. The contractor said the manufacturers assured him the brick would stand the wear. After the breaking test it was shown the brick did not stand the test on account of the inferiority of the burning. They were weak, although the outward appearance was as good as the appearance of the brick that stood the test.

President Ballard: The next thing to be taken up will be the report of the Committee on Street Paving, C. D. Pollock, Chairman.

REPORT OF COMMITTEE ON STREET PAVING.

The Committee on Street Paving has not a great deal to report, but we have a few notes of progress for the year.

In the East, the good work reported last year in getting rid of the cobble-stone pavements, has continued at a rapid rate, especially in Brooklyn, N. Y. Also good reports come from the West telling of new asphalt plants built here and there, improved wooden block pavements laid, brick, bitulithic, etc.

We note too that the United States Government has taken an important step in advance as regards the testing of road materials. The investigation of road materials, which has been carried on under the United States Department of Agriculture for some time, has recently been put under the care of a division in the Bureau of Chemistry, Department of Agriculture. This division is known as the "Division of Tests." The government in raising this to the grade of a division recognizes the importance to the country of having good road materials and in having a suitable place for the proper testing of them.

During the year we have heard very favorable news from the municipal asphalt plants. The Winnipeg plant has been in operation a sufficient time to give us valuable data as will be shown in Mr. Ruttan's paper.

The Detroit plant, unlike the Winnipeg one, is a new one built to be used in repaving and repair work alone, as under the laws of Michigan, the city cannot lay original pavements which are to be paid for by special taxes. In connection with the latter plant there is a municipal laboratory for testing the mixtures.

Omaha has been investigating the question of establishing a municipal plant.

Mr. Samuel Whinery, of New York City, has strongly advocated the use of Portland cement concrete as a paving material for roadways, claiming that it will withstand heavy traffic.

In the 1903 Report of Mr. Chas. H. Rust, M. Am. Soc. Mun. Imps., City Engineer of Toronto, he reports the paving of two streets with Portland cement concrete, laying it in a similar manner to that of cement walks. We hope to hear more of these pavements in Mr. Rust's paper. Bellefontaine, O., and Grand Rapids, Mich., have also tried this pavement. Numerous cities report an increase in tar macadam pavement, and consider it much superior to plain macadam.

The mileage of improved wooden block pavements has increased considerably and advances have been made in methods of testing the blocks, as we shall hear later from one of our members, Mr. Kummer.

The committee wishes to thank the members and friends of the Society who have so kindly prepared the papers for your Committee on Street Paving.

C. D. POLLOCK,
Chairman.

PRESIDENT BALLARD: While we are on the paving question, I think it would be well to take up another paper on that subject. A paper has been prepared by Mr. H. N. Ruttan, of Winnipeg. I think it well to have that paper at this time, as the report and paper can be discussed together. Mr. Ruttan's paper is on "The Municipal Asphalt Plant of Winnipeg."

FIVE YEARS' OPERATION OF THE WINNIPEG MUNICIPAL ASPHALT PLANT.

The Municipal Asphalt Plan was established in Winnipeg in 1899, at a cost of approximately $14,000.00.

Additions have been made from time to time which have materially increased the output and efficiency of the plant.

The capital account at the present time, after making annual allowances for depreciation and maintenance, places the cost at about $20,000.00.

Appendix "A" gives the annual statement of capital account, and the amount charged per square yard of total pavement laid.

CONDITIONS AND METHOD OF CONSTRUCTION.

The following is a condensed description of operations connected with asphalt paving in Winnipeg:

The city is situated on a practically level prairie at the confluence of the Assiniboine River and the Red River of the North.

The street level is about 7 feet above extreme high water, and about 33 feet above extreme low water in the river. The elevation above sea level being 754 feet.

The climate is sometimes extremely hot in summer, and in winter the thermometer occasionally reaches the forties below zero.

The snow fall, considering the latitude, is light, the pavements in places, particularly in the car tracks, for the entire winter being almost or quite bare of snow.

From the above, it is evident that conditions are particularly unfavorable for asphalt pavements.

Notwithstanding the disadvantages, the pavements, with one or two exceptions, show very few cracks.

The work of paving is done substantially in accordance with the specifications, Appendix "B."

Broken stone is used for drains because tile, if used above the frost line, is destroyed by ice.

The three inches of sand and gravel on top of the clay foundation prevents the concrete from adhering to the clay, and being cracked or pulled apart, when frost cracks open in the latter.

The frost penetrates to a depth of from 6 to 8 feet, and cracks, sometimes 6 inches in width, open on the surface. It has not been found that any of these cracks show through the asphalt.

Apart from the above, the methods are those which prevail in most American cities, and are given in the specifications referred to above.

COSTS OF MATERIALS F. O. B. CARS WINNIPEG, 1904.

Portland cement, per 100 lbs	$0.74
Broken stone, per cubic yard	1.30
Sand and gravel, average about	1.00
Crushed granite, per cubic yard	5.00
Asphalt, per ton	26.37
Maltha, per gallon (Imperial)	.12

Labor, 9 hours per day, as shown on various statements.

COST PER SQUARE YARD OF ASPHALT.

Grading, per square yard (including cross drains)	$0.15
Sand foundation	.15
Concrete, 4½ inches	.65
Binder	.28
Surface	.60
Plant charges	.05
	$1.88
Maintenance fund	.20
	$2.08
Engineering and collection expenses 10 per cent	.20
Total cost	$2.28

METHOD OF PAYMENT AND ASSESSMENT.

The cost is divided in different proportions (depending upon the location and character of the street) between the city funds and property fronting on the improvement.

In the residence portions, the city contributes out of the general fund, an amount equal to half the cost of a 24-foot wide macadam, the property fronting, paying the balance.

The 24-foot macadam was adopted some years ago as the standard pavement of the city, the city paying one-half the cost and the property the remainder.

There are a few special streets, business and leading thoroughfares, to which the city contributes out of the general funds one-third of the whole cost.

On streets occupied by the street railway the company pays for 8 feet in width of pavement for each track, and in the case of double tracks, for 17 feet wide in all.

Twenty-year bonds are issued for the original cost of the pavements. The interest and sinking fund for their payment being collected each year.

An account is kept of the maintenance fund (see Appendix "C"), very little of which has so far been expended.

Rates of wages are given in Appendix "D," and daily plant report sheets in Appendix "E."

H. N. RUTTAN.
M. Inst. C. E.
M. Am. Soc. C. E.
M. Can. Soc. C .E.

Winnipeg, Sept. 19, 1904.

APPENDIX "A."

CITY OF WINNIPEG—ASPHALT PLANT ACCOUNT.

CAPITAL ACCOUNT.

1899.

Original cost of plant	$12,322.37	
Road roller, ⅓ of cost	1,200.00	
Tools, ½ of cost	131.13	
	$13,653.50	
Depreciation at 5%	682.00	
		$12,971.50

CHARGED TO WORK OF 1899.

Maintenance and repairs to plant	$568.03
Tools, ½ of cost	131.14
Interest, @ 4% on $13,653.60	546.00
Depreciation at 5%	682.00
Lost taxes	100.00
	$2,027.17

Square yards of asphalt laid in 1899=45,843.45.

Average plant charge per square yard=4.42 cents.

CAPITAL ACCOUNT.

1900.

To balance	$12,971.50	
New sheds, etc.	732.89	
Tools, ½ of cost	61.00	
Maintenance, ½ of cost	524.03	
	$14,289.42	
Depreciation, at 5%	714.00	
		$13,575.42

CHARGED TO WORK OF 1900.

Maintenance, ½ of cost	$524.04
Tools, ½ of cost	60.99
Interest, at 4% on $14,289.00	572.00
Depreciation, at 5%	714.00
Lost taxes	100.00
	$1,971.03

Square yards of asphalt laid in 1900=22,064.

Average plant charge per square yard=8.93 cents.

CAPITAL ACCOUNT.

1901.

To balance	$13,575.42	
New oil tank, smoke stacks, etc.	445.14	
Tools, ½of cost	314.24	
Maintenance, ½ of cost	924.99	
	$15,259.79	
Depreciation, at 5%	763.00	
		$14,496.79

CHARGED TO WORK OF 1901.

Maintenance, ½ of cost	$925.00
Tools, ½ of cost	314.24
Interest, at 4% on $15,260.00	610.40
Depreciation, at 5%	763.00
Lost taxes	100.00
	$2,712.64

Square yards of asphalt laid in 1901=54,536.
Average plant charge per square yard=4.97 cents.

CAPITAL ACCOUNT.

1902.

To balance	$14,496.79	
New grinder, elevator, etc.	955.66	
Tools, ½ of cost	333.87	
Extensions and repairs to plant, ½ of cost	2,528.38	
	$18,314.70	
Depreciation, at 5%	915.73	
		$17,398.97

CHARGED TO WORK OF 1902.

Maintenance and repairs to plant	$2,528.38
Tools, ½ of cost	333.88
Interest, at 4% on $18,314.70	732.59
Depreciation, at 5%	915.73
Lost taxes	100.00
	$4,610.58

Square yards of asphalt laid in 1902 (including repairs)=90,815.6.
Average plant charge per square yard=5.07 cents.

CAPITAL ACCOUNT.

1903.

To balance	$17,398.97	
New steam hoist, engine, etc	1,150.38	
Tools, ½ of cost	236.11	
Extensions and repairs to plant, ½ of cost	2,296.63	
	$21,082.09	
Depreciation, at 5%	1,054.10	
		$20,027.99

CHARGED TO WORK OF 1903.

Maintenance and repairs to plant	$2,296.62
Tools, ½ of cost	236.12
Interest, at 4% on $21,082.09	843.28
Depreciation, at 5%	1,054.10
Lost taxes	100.00
	$4,530.12

Square yards of asphalt laid in 1903 (including repairs)=65,381.3.

Average plant charge per square yard=6.93 cents.

APPENDIX "B."

City of Winnipeg—Specifications for Asphalt Pavement—Residence Streets.

GRADING AND PREPARATION.

The street is to be excavated and graded to a depth of eleven (11) inches below the surface of the proposed pavement, as shown on the plans and cross sections; soft or spongy places not affording a firm foundation, and newly made excavations for trenches or other purposes, that have not been properly filled, will be dug out and refilled with good earth, well rammed. When filling is required to bring the foundation up to the grade, it will be done by the contractor with sound earth or gravel, and the entire roadbed will be thoroughly rolled. The rolled surface must conform closely to the prescribed cross section of the street.

CURB AND CROSS DRAINS.

The curbing will be laid to grades and lines given by the engineer in trenches of the required depth, filled with broken, coarse macadam stone. The trenches shall be graded to catch basins and in no case must there be less than 6 inches of broken stone under the curb in the trenches.

Trenches will be dug completely across the street and connecting with the side trenches, and they will be filled with broken stone to the sub-grade. The cross trenches will, as a rule, be one (1) foot in depth and eight (8) inches wide.

Clean sand and gravel, to be three (3) inches in depth when rolled, will be laid upon the foundation, and thoroughly consolidated by rolling.

PORTLAND CEMENT CONCRETE FOUNDATION.

Upon the sub-grade, as above, will be laid a bed of Portland cement concrete, four and a half (4½) inches in thickness, to be made as follows:

One measure of cement, equal to the best quality Portland cement, and three of clean, sharp sand, will be thoroughly mixed dry, and then made into mortar with as little water as practicable. Broken stone, free from dirt and rubbish, drenched with water, but containing no loose water in the heap, will then be incorporated immediately with the mortar in such quantities as will give a surplus of mortar when rammed. This proportion, when ascertained, will be regulated by measure. Each batch of concrete will be thoroughly mixed. It will then be spread, and at once thoroughly compacted by ramming until free mortar appears upon the surface. The whole operation of mixing and laying each batch will be performed as expeditiously as possible. The fragments of broken stone shall not be more than two (2) inches in their largest linear dimensions.

Concrete may be machine mixed, in which case the process is to be satisfactory to the city engineer.

BINDER COURSE.

Upon the concrete, as above specified, shall be laid a binder course, consisting of broken stone and asphaltic cement, in the proportions of about 15 gallons of cement to one cubic yard of stone. The stone shall be broken to ¾ inch.

The stone shall be heated by passing through revolving heaters and thoroughly mixed with the asphaltic cement. It shall be laid hot, and rolled with hand and steam rollers.

The upper surface of the binder course to be exactly parallel with the finished surface of the pavement.

WEARING SURFACE.

Upon the binder course, as above specified, shall be laid the wearing surface, composed as follows:

Pure bitumen per cent	10 to 12
Sand	85 to 78
Pulverized limestone	5 to 10

Depending upon the character of the asphalt and fineness of sand and limestone.

The above proportions may be varied from time to time, with the approval of the city engineer, provided that the quantity of pure bitumen in the wearing surface is never less than ten per cent. of the whole.

The sand and asphaltic cement are to be heated separately to about 300 degrees Fahrenheit. The pulverized carbonate of lime, while cold, shall be mixed with the hot sand in the required proportions, and then mixed with the asphaltic cement at the required temperature, and in the proper proportions, in a suitable apparatus.

The pavement mixture, prepared as above stated, shall be taken to the ground in carts at a temperature of not less than 250 degrees, nor more than 325 degrees Fahrenheit. It shall then be carefully spread, by means of hot iron rakes, to such a depth, that having received its ultimate compression, it shall have a thickness of two (2) inches at the crown of the roadway, tapering off to one and a half (1½) inches at the gutters. The surface shall then be compressed by hand rollers, after which a small amount of hydraulic cement shall be swept over it, after which it shall be thoroughly compressed by a steam roller of not less than 250 lbs. to the inch run, and the rolling to be continued for not less than 5 hours to each 1,000 square yards of surface.

The powdered limestone must be of such a degree of fineness that 25 per cent. by weight shall pass No. 200 screen, and the whole of it shall pass a No. 80 screen.

The sand shall be clean and sharp and shall approximate the following grading:

Pass	200	screen	25 per cent.
"	100	"	25 "
"	50	"	25 "
"	20	"	15 "
Retained	20	"	10 "

In order to make the gutters entirely impervious to water, where required by the city engineer, a width of 12 inches next the curb shall be coated with hot pure asphalt and smoothed with hot smoothing irons, in order to saturate the pavement to a certain depth with an excess of asphalt.

TESTS AND ANALYSIS OF ASPHALT.

Before asphalt is delivered by the contractor, samples of not less than 3 lbs. in weight shall be submitted to the city engineer ,and asphalt shall be delivered only after the city engineer has expressed his approval, in writing, of the sample.

The city engineer shall place an inspector in the mixing works, whose duty it shall be to see that specified proportions are adhered to in the mixtures, and to take samples of the constituents of the pavement for analysis and record.

GUARANTEE.

The contractor is to guarantee the maintenance of the pavement for a period of ten years from the date of completion of the work, which date is to be taken as that of the final estimate in payment for the same.

As security for this guarantee, the city will retain, after the completion of the work, out of monies due the contractor, the sum of 20 cents per square yard.

The pavement is to be handed over to the city at the expiration of the guarantee period, in good condition and free from settlement, cracks and other defects, which might injuriously affect the pavement.

The contractor shall, on notification from the city engineer, repair any defects as they arise. Should the contractor refuse or neglect to make repairs after having been notified to do so by the city engineer, for a period of 30 days from the date of such notice, the city engineer may proceed to make such repairs, and shall pay the cost of the same out of the guarantee fund retained by the city.

At the end of the 10 years' guarantee period, the balance of the guarantee fund remaining after having paid for repairs as above, shall be paid to the contractor.

Winnipeg, Man., Sept. 3, 1904.

City of Winnipeg--Specifications for Street Railway Works on Asphalt Paved Streets:

The electric railway track and ties will be laid by the street railway company, but all grading, ballasting, draining, concreting and other work incident to the railway will be done by the contractor according to the plans.

The price of schedule per square yard is to cover all work in connection with the railway.

The tender is to include maintenance for a period of 10 years, and 20 cents per square yard will be retained by the city for that period. Repairs where considered necessary by the engineer are to be made by the contractor from time to time upon the engineer's written instructions.

In default of such repairs being made within 30 days of the date of such instructions, the repairs may be made by the city engineer, and cost thereof charged against the contractor, and deducted from the maintenance fund retained by the city.

If frost intervenes, the work is to be suspended during period of frost, and the contractor is to make good any damage which may arise from defects in respect of work damaged by frost, without extra charge to the city.

If the work is suspended on account of frost, it must be fully completed not later than the tenth day of June, 19 , specified time being extended accordingly.

APPENDIX "C."

MAINTENANCE OF ASPHALT PAVEMENTS ACCOUNT—STATEMENT OF ACCOUNT TO APRIL 30, 1904.

1899.		
By pavements laid in 1899		$9,168.69
(20 cents per square yard.)		
1900.		
By balance	$9,168.69	
By pavements laid in 1900	4,412.80	
(20 cents per sq. yd.)		
	$13,581.49	
Less expended in repairs	377.54	
		$13,303.95
1901.		
By balance	$13,303.95	
By pavements laid in 1901	10,765.47	
(20 cents per sq. yd.)		
	$24,069.42	
Less expended in repairs	211.84	
		$23,857.58
1902.		
By balance	$23,857.58	
By pavements laid in 1902	16,762.00	
(20 cents per sq. yd.)		
	$40,619.58	
Less expended in repairs	47.89	
		$40,571.69
1903.		
By balance	$40,571.69	
By pavements laid in 1903	12,731.82	
(20 cents per sq. yd.)		
	$55,303.51	
Less expended in repairs	589.10	
		$52,714.41

N. B.—This statement does not include interest which should be credited to this fund from year to year.

APPENDIX "D."

WAGES AND OCCUPATIONS OF MEN EMPLOYED AT ASPHALT PLANT.

1	superintending chemist	$8.00	per day.
1	foreman	3.00	"
1	engineer	3.50	"
1	night engineer	.25	per hour.
1	mixer	.30	"

1	tankman	$0.25	per hour
1	dustman	.25	"
1	feeder	.25	"
1	miller	.25	"
1	temperature man	.20	"
1	fireman	.25	"
7	laborers wheeling sand and stone	.20	"
2	laborers (tanks)	.20	"
1	night tankman	.20	"
7	laborers unloading sand and stone	.20	"
1	sand box man	.25	"
1	dipper	.20	"
1	boy	1.00	per day.
1	clerk	2.00	"
1	laborer (wood)	.20	per hour.

WAGES AND OCCUPATIONS OF MEN EMPLOYED IN ASPHALT STREET GANG.

1	raker	$2.75	per day.
2	rakers	2.50	"
2	tampers	2.50	"
2	smoothers	.22½	per hour.
10	laborers shoveling asphalt, sweeping, etc.	.20	"
1	watchman	2.00	per day.
1	water boy	1.00	"

WAGES AND OCCUPATIONS OF MEN EMPLOYED IN CONCRETE GANG.

1	sprinkler	$0.22½	per hour.
7	wheelers	.22½	"
7	wheelers	.20	"
2	tending tail carrier	.22½	"
1	feeding concrete	.22½	"
2	carrying track planks	.22½	"
2	feeding stone	.22½	"
1	moving machine	.22½	"
2	feeding sand	.22½	"
1	water boy	1.00	per day.
1	watchman	2.00	"
3	levelling concrete	.22½	per hour.
4	levelling concrete	.20	"
1	tending hydrant	.20	"
8	grading	.20	"
1	oiler	.20	"
1	pounding	.20	"
1	feeding water	.20	"
1	cement man	.20	"
1	machinist	.25	"
1	foreman	4.00	per day.

APPENDIX "E."

City of Winnipeg—Asphalt Works Daily Report—Pavement Main Street North. Date Sept. 3, 1904.

BINDER.

Number of batches
Number of loads
Composition of batch........Lbs. Limestone........Lbs. Asphalt Cement.
Total output: Limestone, cubic yds.
" " Asphalt, tons gross
" " Oil, tons
" " Fuel, cords
" " ....
" " ....

SURFACE.

Number of batches, 204.
Number of loads, 34.
Composition of batch, 900 Lbs. sand; 105 Lbs. stone dust; 130 Lbs. asphalt cement.
Total output: Sand, cubic yds., 81.6.
" " Limestone dust, tons, 10.72.
" " Asphalt, tons gross, 10.2.
" " Oil, tons, 3.978.
" " Fuel, cords, 9.
" " ....
" " ....

TEMPERATURE.

Maximum, 340°
Minimum, 270°
Average, 305°

LABOR.

Firemen,
Engineers,
Mixers,
Melters,
Tankmen,
Clerk,
Laborers,
Teams,
Foreman,

City of Winnipeg—Asphalt Works Daily Report—Pavement Main Street North. Date, Sept. 2, 1904.

BINDER.

Number of batches, 342.
Number of loads, 49.

Composition of batch, 900 Lbs. Limestone; 45 Lbs. Asphalt Cement.
Total output: Limestone, cubic yds., 114.
" " Asphalt, tons gross, 5.92515 Venezuela.
" " Oil, tons, 2.3085.
' " Fuel, cords, 9.
" " ....
" " ....

SURFACE.

Number of batches
Number of loads
Composition of batch.........Lbs. sand.........Lbs. stone dust.........
Lbs. asphalt cement
Total output: Sand, cubic yds.
" " Limestone dust, tons
" " Asphalt, tons gross
" " Oil, tons
" " Fuel, cords
" " ....
" " ....

LABOR.

Firemen,
Engineers,
Mixers,
Melters,
Tankmen,
Clerk,
Laborers,
Teams,
Foreman,

Mr. Ruttan: This is not offered as a perfect example of an asphalt plant. We bought the plant from contractors. Then we patched it up the best we could. The paper is designed to give you a record of five years' running of a municipal asphalt plant.

Mr. Adam: You say you lay clay on the gravel to a depth of three inches and that prevents cracking of the asphalt. I should like to know if you have had an opportunity to see if any cracks were present in the concrete. Have you had such an opportunity?

Mr. Ruttan: I might say the cracks we tried to provide against were the immensely wide cracks that occur in some paved streets. If such a crack had occurred in the concrete it would soon show on top of the ground.

MR. ADAM: Asphalt companies have always claimed when cracks occur on the surface of the asphalt that they were due to the shrinkage of the concrete. I recommend leaving contraction joints every few feet in the concrete part. None of the contractors have done this, although they claimed the cracks in the asphalt were due to the cracking of the concrete. I should infer that Mr. Ruttan's method obviated this cracking.

Mr. Ruttan states that the cost of the binder was twenty-eight cents per square yard. I should like to know how thick that was?

MR. RUTTAN: One and one-half inches.

MR. ADAM: How does the work done under your direction compare with the work done by the contractors? I wish to know if the work done in a municipal plant is superior to the work done by contractors.

MR. TILLSON: Do you mean in cost?

MR. ADAM: No; in quality.

MR. RUTTAN: Had I included the report of the maintenance fund in this paper you would have seen that out of the whole fund from the beginning we have only expended a few hundred dollars. We still have fifty thousand dollars in stock for future repairs. Some of our pavements are over five years old. This goes to show that if a pavement is well laid a five years' guarantee fund is of very little importance.

PRESIDENT BALLARD: The assumption is that your work is superior to the work of contractors.

MR. RUTTAN: It is. Up to the present time we have spent practically nothing for maintenance. In addition to that the total cost of our work is from twenty to seventy-five cents per square yard less than similar work done by contractors in the city.

MR. ADAM: Winnipeg is probably the only city that has introduced the method of laying pavements by the municipality. Mr. Capellen, of Minneapolis, once recommended that the same thing be done by that city. He laid some brick pavement, not under contract, and I think he showed he could lay it cheaper than if it was done by a contractor. Now the question is, would that be the experience of each city? The city of Winnipeg has certainly set a good example to other cities. As to the three-cent guarantee, the city of Newark had to pay as high as twenty-five cents, five cents a year for a guarantee of five years. It afterwards reduced its guarantee to two and one-half cents a year for the second period of five years. The statement was made to me by one of the asphalt companies that their experience was that in 65,000 yards of asphalt pavements it did not cost a cent a yard for the second period of five years.

Mr. Chausse: The city of Montreal has an asphalt plant, and they do their own repairs. We also build our own pavements.

Mr. Tillson: Have you ever laid any of the asphalt without the foundation of gravel and sand under the concrete, and if so, did you get cracks then?

Mr. Ruttan: We have laid none without the gravel under the concrete. Our soil is very heavy clay—we call it gumbo clay.

Mr. Reimer: Do you find that the clay cracks underneath the pavement after the pavement is laid?

Mr. Ruttan: We have not had an opportunity of seeing. If it cracks underneath I imagine it would also crack on the outside.

Mr. McKendrick: Would not the fact that in Winnipeg the pavement is practically waterproof and the clay does not absorb the water cause it to crack less? In Toronto we find that all the expansion cracks, all the broad cracks which run across the street, are always in the concrete. Many longitudinal cracks have appeared there both in pavements on clay soil and on very sandy soil. A few years ago I tried the experiment you mention of putting an expansion joint every fifty feet in the concrete. We found the asphalt would open there and sometimes it would open six or eight feet from there. Then we let that plan lapse and allowed the pavement to crack where it would.

Mr. Adam: That is owing entirely to the expansion and contraction of the asphalt surface itself. Where asphalt pavements have been joined on to brick pavements the brick pavement would expand and buck up against the asphalt. Everybody knows that in the summer the asphalt gets very plastic and expands, and when cold weather comes it contracts and causes these cracks. It is very difficult to mix asphalt so it will stand the extremes of temperature. I know of one case where asphalt was laid with an overdose of bitumen. When travel began on this pavement the hoofs of the horses made tracks on it. After one winter's exposure the pavement showed cracks from curb to curb. The pavement was too soft and it expanded too much in hot weather.

MR. MCKENDRICK: In 1899 I laid some asphalt pavements in Toronto, Canada, late in the fall. One night the thermometer showed a variation of 35°, but it did not go down to the freezing point. No asphalt was laid at that time, but the concrete cracked regularly, the cracks being from thirty to sixty feet apart, clear across the street, including a curb and gutter. A few years ago I laid a pavement from the rail to the gutter. The gutter was composed of three rows of paving block and a flat paving stone. The only two cracks I noticed in that street started from the rail, went through the three rows of paving blocks, through the asphalt and through the stone gutter. That shows the trouble was not in the asphalt, but in the concrete base.

MR. TILLSON: It seems to me the cracks may be, and without doubt are, due to both these sources. In such a climate as Mr. Ruttan mentions, where they sometimes have a temperature of 40° below zero, and have cracks six inches wide in the earth, it certainly does seem as if it would be absolutely necessary to make some provision for preventing the cracks under the pavement. In Brooklyn, where we seldom have it below zero in the winter, and where the soil is very sandy, it does not seem necessary to make any provision for cracks. Although we do have a few cracks in the pavements, where they do occur it is almost always possible to trace the trouble to some particular kind of asphalt. I don't believe that when you take an asphalt pavement that cracks badly it is due to any contraction of the concrete. I think it is on account of improper mixture of the asphalt material. We had one case last spring where the first guarantee had expired, at the end of which the twenty per cent. was due to the contractors, and on the side of the pavement where the traffic was light the asphalt cracked irregularly. We took that pavement all up. On the rest of the street the pavement cracked across. I think that was due to the mixing of the asphalt material rather than to the concrete.

It does seem as though something more ought to be said about this asphalt repair plant to show that everybody has an appreciation of the work Winnipeg has done in demonstrating to this country that asphalt can be laid by a municipality for less than it can by contractors. There has always been a sort of mystery connected with the laying of asphalt pavements. City officials seem to think it must be done by contractors, and have hesitated to have anything to do with the work themselves. When the asphalt pavement industry has attained the proportions it has today, and when there are so many cities that have over one hundred miles of asphalt pavements, it is going to be only a few years until those pavements are out of guarantee and the cities will be more or less at the mercy of the asphalt contractors unless the municipalities maintain their own plants. At the present time Brooklyn has some twelve hundred thousand square yards of pavement out of guarantee, and in five years they will have more than double that. No city should be in a position where it cannot repair a street promptly when it is necessary. In a few years every city that has any appreciable amount of asphalt pavement will be making their repairs themselves. Winnipeg has demonstrated that the original pavement can be laid for less cost by the city than by contractors. That, of course, is a different proposition and involves a different question. It involves the propriety of doing the work by the city. That is an important consideration. I presume in all the United States it is necessary to do the work, where an assessment is to be made, by public contract, and in a great many places where the work is paid for by the city. Last year I recommended an asphalt repair plant for Brooklyn, and I think one will be constructed before a great while. The city of Detroit established its plant last spring, and remarkable results have been shown in the way of keeping pavements in repair.

Any figures upon the actual cost of any asphalt work is of great importance. The asphalt paving industry is increasing so rapidly that it seems to me in a very few years a great many cities must be making their own repairs, at least, and in this connection I would like to quote the figures given by that city for work done by the municipal asphalt plant recently constructed there, from June 8th to July 13th, inclusive. The figures I take from the technical press:

115.8 tons asphalt at $25.50	$2,952.90
52.17 tons asphaltic oil at $25.90	1,351.60
671.76 cubic yards sand at 56 cts	376.13
293.90 tons binder stone at 90 cts	264.51
84.96 tons limestone dust at $3.50	297.30
83 tons of coal at $2.65	219.90
28 cords wood at $3.65	102.20
Lubricating oil	18.00
Cement	13.30
Total	$5,596.00
Cost of labor at plant, including office and teaming from plant	2,129.50
Cost of labor on street, including foreman and hauling off old material	3,135.90
Cost of unloading material at plant, cleaning up about plant, interest on plant and $100 allowed for repair	378.32
	$11,248.89
Cr.	
Receipts for screenings, old oil barrels and work for street railway company	150.00
Net cost	$11,098.89

Yardage—	
Woodward Avenue	3,837.10 yds.
Lafayette Avenue	7,642.38 yds.
Fort Street	1,296.81 yds.
Total	12,776.29 yds.

Average cost per yard	86 8-10	cts.
Cost of material per yard	43 8-10	cts.
Cost of labor per yard	43	cts.
Cost of 12,776.29 yrds at $1.12	$14,309.44	
Actual cost	11,098.89	
Saving	$3,210.55	

It is probable that these figures would be modified somewhat when the year's work comes to be considered, but the results are certainly very satisfactory, and even if fixed charges for the year do modify somewhat this statement, it cannot be very much, and the operations of this plant, as well as that of the one at Winnipeg, certainly demonstrates the fact that municipalities can operate asphalt plants cheaply. At the present time, nearly every city that has asphalt pavements is dependent upon the contractor for all repairs. This certainly does not seem right, and the only solution of it is in the city maintaining an asphalt repair plant of its own.

Mr. Adam: The low cost of the Detroit plant may be due to the fact that they have used old materials to make repairs with. It makes a difference whether you use new materials or not.

Mr. Tillson: They take new materials, because in the statement given out they give the cost of new material. They use Venezuelan asphalt which costs twenty-four or twenty-five dollars a ton.

Mr. McKendrick: I think the first requisite in getting a repair plant, if Mr. Ruttan's plan or system is carried out, is to get competent men to handle it. There is no question about the city being able to lay asphalt as well as anybody else. I have watched Mr. Ruttan's work very carefully, and recently sold the city of Montreal a paving plant. They are not doing anything like the successful work Mr. Ruttan is. I think that is due to the fact that they have no one in the employ of the city that knows anything about asphalt. The plant was an excellent one. They have equipped the plant well; I have seen twenty-five or thirty plants in the United States and have seen nothing like it. The plant is steel, and they have built an immense shed over it. I notice that the work they did last year is not good work. There is one stretch of about a thousand feet where the asphalt is scaling off to a thickness of about one-half inch. This shows that either they have not put enough bitumen in it, or that they have not compressed it enough and the water has got in to that depth the first year. But if any city will adopt the plan and will get the advice of experts they can certainly save the contractor's profits.

MR. ADAM: Do you object to stating what occupation you pursue?

MR. TILLSON: He is evidently a contractor from Toronto.

MR. RUTTAN: It should be taken for granted that if a city establishes an asphalt plant they will secure experts to run it properly. As Mr. Tillson has said, there is no longer any mystery about laying asphalt. The very best men can be secured; men who will lay the pavements in a thoroughly practical and substantial manner. We have used in Winnipeg, I think, every kind of asphalt that is produced on the continent. When we started we used a California asphalt, and the following year, when we tried to secure some of the same kind we found the company had been absorbed by the trust. For the rest of the year we used four or five kinds of asphalt picked up where we could get it. I think none of the asphalts are really bad, and all that is required is proper management and supervision of the work.

MR. TILLSON: As far as obtaining competent men is concerned, the situation is very different now from what it was five years ago. The formation of the National Asphalt Trust has let loose a great many asphalt men who were employed by the Barber Company before, and who are not only willing, but anxious to get work and to demonstrate that work can be done by other people than the Barber people. While it might have been difficult to have obtained such men before the formation of the trust, it is very easy to do it now. As one friend of mine said: "The new company seems to want to get rid of everybody that knows anything," and, judging by some of their actions, that seems to be true. They seem to want to concentrate all knowledge of the business in two or three men who are running it.

President Ballard: The next thing in order is the report of the Committee on Sewerage and Sanitation, Mr. Adam, Chairman.

Mr. Adam: Both of my colleagues notified me they could not serve. Being pressed with work I did not find time to write anything as a report for the committee.

President Ballard: If the Committee on Sewerage and Sanitation has no report to make, we will hear a paper on "The Use of Sulphur for Sewer Pipe Joints in Wet Trenches," by E. S. Rankin.

THE USE OF SULPHUR FOR SEWER PIPE JOINTS IN WET TRENCHES.

BY EDWARD S. RANKIN, NEWARK, N. J.

During the latter part of the year 1903 my attention was called to a new form of pipe joint which was being used in the construction of a system of sanitary sewers in the village of South Orange, N. J. The system consisted of about 23 miles of small pipes ranging from eight to twelve inches in diameter and discharging into an outlet to tide water which was used also by several adjoining municipalities. As the capacity of this outlet was limited, the question of water tight sewers became an important one, particularly as ground water was encountered on the greater part of the system. The engineer of the work, Mr. Alexander Potter, after experimenting with several forms of special joints finally hit upon the plan of joining the pipes with a mixture of melted sulphur and fine sand. A description of the joint with an account of his experiments was published in the *Engineering Record* of March 12, 1904. Mr. Potter has since successfully used this construction on the West Orange system, entirely discarding cement joints.

The city of Newark having at the time just awarded a contract for the construction of some 4½ miles of small pipe sewers, connected with the same outlet above mentioned and expecting to find water on a considerable portion of the work, arrangements were made with the contractor to use this form of joint in the wet sections.

Similar arrangements have since been made on another contract now under construction.

Briefly described, the joint is formed by first calking the annular space between the hub and spigot with a strand of jute and then filling the remaining space with the melted mixture in a similar manner to pouring lead joints in cast iron pipe. The melting is done in an ordinary lead furnace, care being taken to remove the pot before too high a temperature is reached. On one small section requiring only a few joints the contractor used an oil stove, which answered every purpose. It is found convenient in practice to join two or three lengths of pipe in cradles on the surface, thus leaving only one joint in every three or four to be made in the ditch. Joints can be made easier and better in this way and the work advances more rapidly, as a number of the jointed sections can be made at odd times and kept in reserve. They can be freely handled or lowered into the ditch within a few minutes after pouring.

Where water stands in the ditch, this must of course be kept down by pumping while the joint is being made, but may be allowed to rise immediately afterward.

In the experiments above referred to it was found that equal parts of sand and sulphur stood the highest test, the finest sand giving the greatest strength. Dried quick sand apparently being the best material.

When the preparation of this paper was decided on, in order to be able to speak from personal experience, a number of experiments were made to determine the strength of the mixture under varying conditions. The briquettes were moulded in the field from the mixture in actual use on the work and broken in a Fairbanks machine. As might be anticipated, the results were not as high nor as uniform as those obtained in the original laboratory experiments, in fact the tensile strength of briquettes made and broken under apparently similar conditions ranged from 188 to 636 lbs. per square inch. This is due very largely to improper mixings, the weak samples invariably showing a considerable section of free sulphur at the top. When it is considered that pure sulphur breaks at only 100 lbs., while the average strength of a good mixture is from 350 to 400 lbs. per square inch, the necessity for thorough mixing is apparent.

Briquettes were broken at ages ranging from 18 hours to 28 days, the age apparently having no effect on the strength. One set was kept in boiling water for 12 hours and another immersed in sewage for 28 days. Still others were made with a view of determining the proper temperature at which the mixture should be used. This was found to be between 240° and 300°. Both above and below these limits the liquid becomes thicker and does not give such good results.

Recently during the progress of the work there was encountered a bed of what is locally known as "bull's liver," seemingly a combination of quick sand and clay in a very finely divided state. This material has proved even better than the sand, giving a more uniform mixture and a higher average test. Acting on the hint thus obtained, some samples were made with pure blue clay, dried, powdered and sifted through a number 30 sieve.

The following table shows the result:

Average of 15 briquettes made with equal parts sulphur and sand, varying in age from 24 hours to 28 days and broken under normal conditions—343 lbs. per sq. inch.

Average of 3 briquettes of same mixture, boiled for 12 hours—285 lbs.

Average of 2 briquettes of same mixture immersed in sewage for 28 days—288 lbs.

Average of 9 briquettes made with equal parts sulphur and sand and clay, age from 18 to 30 hours—385 lbs.

Average of 3 briquettes made with 3 parts sulphur to 2 parts powdered blue clay, age 18 hours—400 lbs.

Still more tests are needed to definitely determine the best material and proportions to be used; also more particularly whether long exposure to the action of sewage will have a deleterious effect. Briquettes have been made and placed directly in the main intercepting sewer of the city and will be broken at intervals through the coming year, comparison being made with others made at the same time and kept unexposed.

The amount of absorption was also tried; a small brick weighing about 2½ pounds being made and after weighing, immersed in water for 24 hours. The absorption was found to be about 3/10 of one per cent. of its weight.

Naturally the most practical test of all is the result obtained by gauging the ground water flow in the complete work; and in this the sewers referred to above compare favorably with those tabulated by Prof. Folwell in his paper read before this Society last year.

This system consists of 736 feet of 12-inch pipe, 2,317 ft. of 10-inch pipe, 18,718 ft. of 8-inch and 1,900 ft. of 6-inch house connections, a total of 4.48 miles, draining an area of 137 acres. Of this total practically all of the 12-inch, 10-inch and 6-inch pipe and about 5,000 feet of 8-inch, or a total of 1.77 miles was laid with the sulphur joints. On the balance of the system where the ground water could be kept below the inverts of the pipes without pumping, cement was used. The main line was laid at a depth varying from 7 to 24 feet with water throughout its entire length. On some of the branch lines averaging 8 feet deep, water was encountered from the surface down, one piece of about 200 feet being laid through a pond. It is to be remembered that at the commencement of the work neither the contractor nor the engineer had had any experience with this form of construction; the first sand used was too coarse, and in some instances the mixture was used at too high a temperature, resulting in a porous joint. Unfortunately the two sections first opened proved to be the worst in the matter of ground water of the entire system.

The gaugings of the completed work showed an infiltration of 0.22 cubic feet per second, which amounts to 32,000 gallons per mile per day, or 1,100 gallons per acre per day. Compared with the systems recorded by Prof. Folwell, the Newark sewers stand fourth in the list of eleven there given.

For the purpose of comparison the table is here reproduced in condensed form, omitting the brick sewers and inserting the Newark system.

City.	Gallons per mile per day.	Gallons per acre per day.
Schenectady, N. Y.	4,000	
Champaign, Ill.	30,000*	
New Orleans, La.	31,800	1,941
Newark, N. J.	32,000	1,000
Boston, Mass.	40,000	
East Orange, N. J.	43,250	
Several cities in Massachusetts	75,000*	
Malden, Mass.	83,000	
English city not named	140,000	
Westboro, Mass.	610,000	
Unnamed city in New York State	1,300,000	
Another section in Westboro, Mass.	1,320,000	

Excepting Schenectady, Newark stands within less than 10% of the highest, which is probably as close as gauging of this kind can be made.

On the other Newark system referred to no gaugings have as yet been taken as it is still in course of construction, but indications point to still better results.

As to cost, one barrel of sulphur weighing 250 lbs. and costing about $6.25, is sufficient for from 95 to 100 joints on a 12-inch pipe.

Taking this cost at seven cents with one cent for jute, one cent for fuel and as near as can be estimated six cents for labor, the total cost would be fifteen cents per joint, or five cents per lineal foot using three foot lengths. The cost for other sized pipes will vary nearly in proportion to their diameters.

While the work herein described is to be considered more as experimental than as conclusive, it is believed that where the securing of water tight work is an important feature, the sulphur joint can be substituted for cement with material advantage.

Newark, N. J., Oct. 1, 1904.

MR. TILLSON: I should like to ask if it is necessary to have the pipe dry in order to pour this?

MR. RANKIN: As I stated, we join at least two pipes on the surface. Those are, of course, dry. In the ditch we keep the water down below where we make the inverted joint. There is no water around the pipe. We put what the workmen term a "snake" around the joint and then pour as you pour lead.

MR. REIMER: The human factor becomes an element in all these things. I have found before even the connections were put on a mile of sewers, there was a beautiful stream of water running through it. While I have no doubt the joints will be tight if properly made. The human factor comes in here, and unless the joint is properly made the water will also come in. I know of over a mile of sewer where a fine stream of water is running through it; probably fifty thousand gallons a day.

MR. RANKIN: I don't believe the joints are absolutely tight. Of course the personal equation comes in here the same as everywhere else. The joints I have described can be made tighter than cement joints. Personally I cannot make a perfectly tight cement joint. In one case I laid a line some one hundred feet in length. Just clear of the water we laid another line, and that was with cement. After a heavy rain storm, a few days after, I found more water in the high line which was laid with cement than in the wet line which was laid with sulphur.

MR. FOLWELL: I am sorry Mr. Ogden is not here. He has made experiments in the college laboratory to determine what he could in reference to the joints. He made some joints in the laboratory, supposedly under more advantageous circumstances than in the trench, and he said he found it almost impossible to make tight joints. He found, among other things, that in the joints which he made the sulphur cooled before it reached the bottom of the joints. The writer said the compound should not be heated beyond 160°; beyond that it loses its efficiency. If it is not heated as much as that it may cool before reaching the bottom of the joint in cold weather. Mr. Ogden was very much disappointed in the material, but admitted that it might be because he had not yet learned how to handle it.

MR. ADAM: Mr. Rankin says the infiltration of water in the city he mentions was less than in other cities. I should like to know what method they pursued to reduce the quantity of water. I think a tight joint can be secured if a molten mass, such as the sulphur compound, is poured in with burlap wrapped around the joint. I think someone in New York has patented a process in which burlap is wrapped around the joint and compressed air used in filling the joint. The argument was that with the ordinary cement joint, when the pipe is laid the cement settles down in the bottom and leaves a vacant space on the top. This open space on the top is the cause of the leakage in wet ground. Even if the ground should be dry, under the action of tide water or in wet weather the water would rise that much and cause heavy infiltration. I think his argument is a good one. I think the material in a liquid condition should be filled in until there can be no possibility of any vacant space being left.

MR. RANKIN: Answering Mr. Folwell's question about Professor Ogden's not being able to get the sulphur compound to go to the bottom on account of chilling, I have not observed any such results. However, I do not know how it would be in extremely cold weather.

MR. ADAM: I think it is a material that chills very readily.

PRESIDENT BALLARD: This, gentlemen, includes all the papers I have any knowledge of.

MR. SHERRERD: I move that the authors of the several papers that have not been read have the privilege of presenting them to the Secretary, and that they be printed at his discretion.

The motion was seconded and carried.

MR. SHERRERD: I would also suggest that the Secretary write to these gentlemen who expect to deliver their papers tomorrow and explain that the convention was completed today.

MR. BROWN: I find there is some misunderstanding about the announcement I made yesterday about Civic Day at the fair. Tomorrow is Civic Day. There is a question whether this Society was not neglected in receiving an invitation to come to this meeting. I think I should make the explanation, as my name appears on the programme. The intention originally was to have this Civic Day in June. I was invited by Mr. Butler, at the suggestion of Mr. Woodruff, to present a paper. It was later found best to postpone Civic Day until this time. Then the question was brought up of making a combination with the other civic societies. There was some effort to add to the three societies named in the programme our own Society. The Programme Committee thought best not to do that, so if we are not on the head of the programme and if we haven't received an invitation formally it is our own fault. Of course they will be glad to have the members of this Society present at the meeting tomorrow. The meetings are being held in the Town Hall, in the Model Street.

MR. REIMER: The question of Portland cement concrete was brought up. I judged that the thought in the mind of the writer or speaker was that it might be more permanent and less liable to destruction. We have had within a few weeks in our little city an experiment made with Rosendale cement concrete underneath Portland cement and reinforced steel construction. The concrete company is building a storehouse of three stories with floors and beams of cement. There is a line of columns through the center of the building, and there was supposed to be placed under them a concrete footing about four feet square and eighteen inches thick. Everything stood well for about three months. The concrete footings were put in about three months ago. Everything was all right until they got the roof partially up. Three weeks ago the owner found the central portion of the floors going down. Every column had been pushed through, or apparently pushed through the concrete footing. Probably they were then carrying about twenty-five tons each on a little over a foot square. Before the settlement was complete the floors in the center of the building had gone down fourteen inches. I thought possibly it would be well for some of you to know this. This is the first building of the kind attempted in our city. I did not see the footings put in, and did not know what they were until after our building inspector called my attention to the matter. If Rosendale cement concrete is going to put us in that shape we want to be guarded as to how we use it.

MR. TILLSON: That was not Portland cement.

MR. REIMER: No, sir, Rosendale hydraulic cement. Of course there may have been some bad work, but that I have not been able to discover.

Mr. Sherrerd: I move that when we adjourn, we adjourn to meet at 9:30 tomorrow morning to receive such papers as may be presented, and for general discussion.

The motion was seconded.

Mr. Sherrerd: It seems to me it would be but scant courtesy for us to adjourn without giving those who will come here an opportunity to read their papers.

Mr. Folwell: I know some of the men are very busy, and they have been very kind to prepare these papers. I think we ought to at least meet and see whether they are ready to present these papers.

The motion was then voted on and carried.

Mr. Reimer: Would it not be well to have a committee appointed to find out whether these gentlemen are in the city or whether they will be here tomorrow?

Mr. Eggers: If we are to meet here tomorrow morning at 9:30 and these gentlemen who have prepared papers are here it will be all right; we can go on and have them read and discussed. If not, we can finish up any routine business we may have on hand and adjourn.

The session was then adjourned to meet at 9:30 Thursday morning.

THIRD SESSION.

The third session was called to order at 9:30 A. M., Thursday. October 6th, President Ballard in the chair.

Mr. Sherrerd: I thing a small matter was overlooked yesterday that should receive attention.

I move that the Executive Committee be authorized to fix the amount of the Secretary's compensation.

The motion was seconded and carried.

President Ballard: We have met here this morning to hear papers that have been prepared for this meeting. We were informed that the writers of some of the papers mentioned in our programme would be here this morning, and for that reason called the convention together.

Mr. Tillson: Mr. Rust has a paper that is to be presented this morning.

President Ballard: We will hear Mr. Rust's paper now if the author is ready to read it. The paper is on "Concrete Pavements in Toronto."

CONCRETE PAVEMENTS.

BY C. H. RUST, CITY ENGINEER, TORONTO, CANADA.

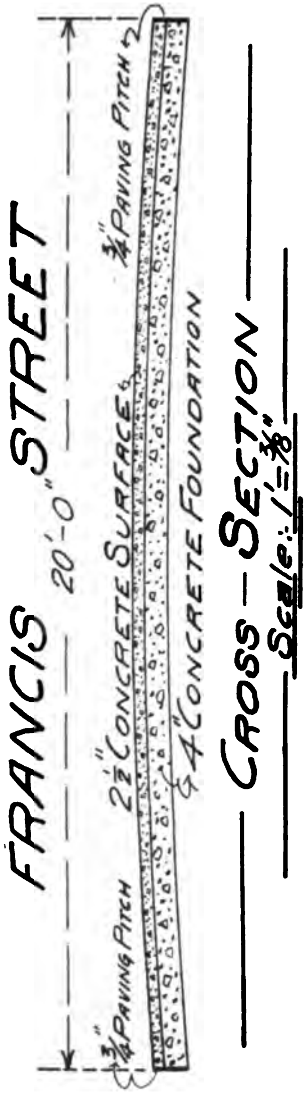
The following brief account of the construction of concrete pavements in Toronto may be of some interest to the members of the Society.

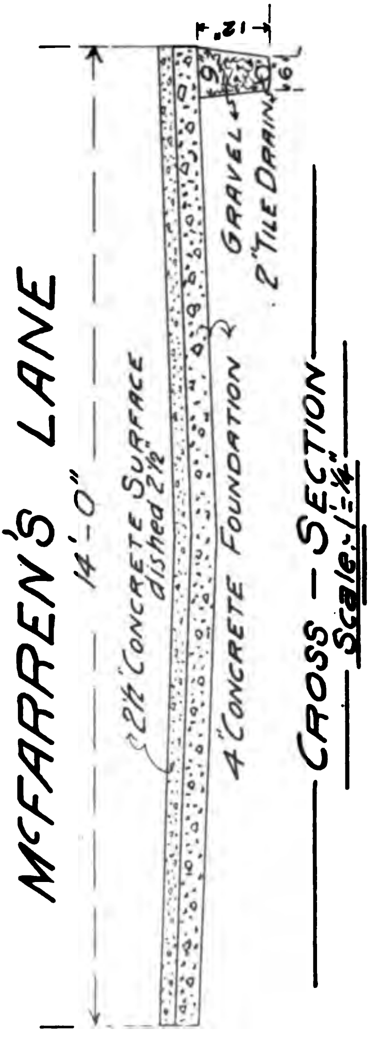
The first concrete pavement was laid in Toronto in 1899 on the track allowance on King street. The asphalt pavement between the tracks on this street being worn out, it was decided to remove 2½ inches of the material and 3 inches of the concrete foundation to permit of scoria brick blocks being laid, but owing to the excessive cost and the labor involved in cutting the concrete foundation, it was afterwards decided to lay a surface of concrete, 2½ to 3 inches in thickness, somewhat similar to that used in the construction of sidewalks, a joint being left every six feet.

The concrete was composed of one part of cement, one-half part of sand and two parts of crushed granite. The cost was from 65 to 75 cents per square yard and the work was carried out by the City Engineer's Department. Next to each rail was placed a row of paving blocks laid as stretchers. Owing to the very large amount of traffic, this pavement has not proved entirely successful and had to be repaired in 1902. The pavement cracked near the rails and the constant traffic broke up the surface. This disintergration was probably due, to some extent, to the settlement of the rails.

A similar pavement was constructed in 1900 upon the Sherbourne street track allowance. This is a residential street, and the pavement has given good satisfaction, showing no signs of wear.

Bloor street track allowance was also paved with concrete the following year and is in good condition. The former pavement upon both Sherbourne and Jarvis streets was asphalt, and it was to avoid breaking up the concrete foundation that a surface coating of concrete was used.


FRANCIS STREET
20'-0"
¾" Paving Pitch
2½" Concrete Surface
4" Concrete Foundation
¾" Paving Pitch
Cross-Section
Scale: 1'=⅛"


McFARREN'S LANE
14'-0"
2½" Concrete Surface dished 2½"
4" Concrete Foundation
12"
6"
6"
Gravel
2" Tile Drain
Cross-Section
Scale: 1'=¼"

Francis street, which is a short thoroughfare subjected to a great deal of trucking, was paved with concrete in 1903, the foundation being composed of one part of Portland cement, three parts of sand and seven parts of broken stone, which is a similar foundation to that used for asphalt or brick pavements. Before the foundation had time to set, a 2½-inch surface of what is called granolithic concrete was put on. This forms the wearing surface and consists of one part of cement, one part of sand and three parts of crushed granite, and is marked off in blocks five inches by twelve inches, which gives it somewhat the appearance of a scoria block pavement. Concrete walks with curb were laid on this street previous to the concrete pavement, and expansion joints were therefore provided throughout the entire width of the pavement by leaving an opening one-inch wide along each curb, paving pitch being run into it until the opening was completely filled. Longitudinal expansion joints were also provided by leaving an opening three-quarters of an inch wide through the pavement, the space being filled with pitch. It would have been better to have made the longitudinal expansion joints only one-half inch wide, as it is noticed that the heavy traffic has a slight tendency to break away the concrete pavement at these points. With this exception, the pavement is in very good condition, no cracks being visible. The cost of this pavement was $1.74 per square yard, the work being carried out by the City Engineer's Department.

A similar pavement was laid this year upon McFarren's Lane, but it was dished to the center. This street is not subjected to as heavy traffic as Francis street. It cost $1.92 per square yard, the work being done by the City Engineer's Department. Attached to this paper is a cross-section of Francis street and McFarren's Lane.

The concrete pavement has not been constructed in Toronto for a sufficient length of time to enable the writer to form an opinion upon its wearing qualities. Teamsters and others using the pavement, appear to like it as it affords a fairly good foothold for horses. It is also cheap and easily cleaned and if the wearing surface will last, it will be a much cheaper and better pavement than stone blocks.

President Ballard: There is one thing I want to get clear in my mind, and that is in regard to the taking up of the asphalt. Did you not also take up the binder?

Mr. Rust: We did not have the binder in those days. When we first constructed our track line pavements in 1892, we used asphalt for a number of them between the rails. It did not last and we used the other pavement.

Mr. Sherrerd: Is not traffic kept off the tracks largely in Toronto?

MR. RUST: The difficulty is, of course, to keep the street closed a sufficient length of time to allow the concrete to become set. In Francis street there is a great deal of heavy traffic, but the pavement is wearing better than I expected. The price, $1.79 a square yard, including the grading, makes a very cheap pavement. The street there is paved from curb to curb.

MR. TILLSON: Did I understand you to say you took up the old asphalt and replaced it with this concrete?

MR. RUST: Yes.

MR. TILLSON: Did the new concrete adhere to the old?

MR. RUST: Yes; we had no trouble at all. It is standing there in good condition.

PRESIDENT BALLARD: I think it would be hard to take the concrete up in places. I have seen it taken up in Brooklyn, and in an endeavor to take up the surface they have taken up the whole thing.

MR. TILLSON: That is where there were three or four pavements, one on top of another.

MR. RUST: We only did it between the tracks of the street railway.

MR. TILLSON: You have some streets that are paved the entire width, have you not?

MR. RUST: Only two, and two or three lanes.

MR. BROWN: Is the pavement slippery?

MR. RUST: No.

MR. BROWN: How large are the blocks into which you cut it?

MR. RUST: About five by twelve inches.

MR. BROWN: The difficulty with the pavement in Bellefontaine, Ohio, was its slipperiness. They had to cut it into grooves to obviate that.

MR. RUST: We cut this into grooves. We had no difficulty of that kind.

MR. BROWN: After the grooves were in they still had trouble of that kind with the Bellefontaine pavement. The oldest street in Bellefontaine has been down eleven or twelve years. It has worn well, but all this time they have had this difficulty. It is on the main business street, where there is considerable travel for a small town. It is hard for country horses, at least, to get along.

MR. RUST: We have had no complaints of that kind.

MR. GIDDINGS: It depends somewhat on the grade, does it not?

MR. RUST: Yes.

MR. POLLOCK: Have you made any cuts in the pavement where you say you put the two and one-half inches of new surface on the old to see how it bound?

MR. RUST: That was between the tracks only. We laid the first concrete between the rails. We put it close up to the rails, but the jar of the cars cracked the concrete, so the next piece we laid we put down a stretcher of granite next the rails, which helped it very much.

MR. TILLSON: Did I understand you to say the proportions were one of cement, one of sand and three of crushed granite?

MR. RUST: We used one part of cement, one-half part of sand and two parts of crushed granite. We altered that when we paved Francis street, which is paved from curb to curb, and used one part cement, one part sand and three parts of crushed granite.

PRESIDENT BALLARD: I see here the Chairman of the Committee on Waterworks and Water Supply, Mr. Hatton, of Wilmington. Mr. Hatton, we are ready for the report.

MR. HATTON: In the first place, Mr. President, I owe you an apology because I did not get here sooner. I left Monday without getting my papers from my office, so I did not know where you were meeting. I spent all of yesterday trying to find out where you were. That is not an exaggeration. I finally met Mr. Adam last evening about half past ten, and he told me.

MR. ADAM: I must acknowledge that Mr. Hatton did not look as though he had been astray.

MR. HATTON: I am sorry my report came out of order. I took up this matter of the waterworks early in the season, and I wrote to a number of the members of the Society asking them to give us some papers to advance the interests of the Society, and I only received one favorable reply, from Mr. Phinney, who agreed to furnish a paper. I don't know whether it has been furnished or not. I took occasion to write a short paper upon a subject in which I am particularly interested, a subject that has come under my notice for some length of time. It is more in the nature of an argument; there is no technical matter in it, and if you will permit me I will run over it.

MUNICIPAL OWNERSHIP OF WATER SUPPLIES.

BY T. CHALKLEY HATTON, OF WILMINGTON, DEL.

Perhaps there is no other subject relating to municipal government which has been so much talked of and written about in the last fifty years as has the subject of this paper, and the writer, in his most lucid moments, does not hope to add anything original to what has been already said. His object in going over the premises again at this time is two-fold. First, to remind the American Society of Municipal Improvements, which is exclusively composed of men who are banded together to advance the interests of the cities, towns or villages of their adoption, of the fact that the general answer to this question is far from being unanimous, and further to urge those members of this Association, who believe as the writer, to assist in educating the masses interested in municipal government to the principle that there is no question which so nearly affects the health, comfort and prosperity of the community as the ownership of the water supply. Second, the writer hopes, through the circulation of the Proceedings of the Association, to reach the eyes of the hundreds of men in towns and villages, having the responsibility thrust upon them of determining the ways and means for installing a public water supply, believing that this paper may, in its small way, answer many of the questions which their lack of experience in municipal affairs has precluded an otherwise satisfactory solution.

To many of the members of this Association this question may not appear as an important one, or it may seem to be one to be decided entirely by local conditions, and yet out of the 1,437 municipalities in the United States having public water supplies, 661 are owned and controlled by private interests. That is to say, the citizens of 1,437 municipalities in the United States have at one time during the progress of the town wrestled with the problem of private or municipal ownership of the waterworks, and have settled it in accordance with their individual enlightenment and not in accordance with purely local conditions. That is to say, that if the citizens responsible for the granting of a franchise to private interests for the construction and operation of a public water supply had been as well informed as to the effect of such a grant upon their welfare when they voted as they were ten years thereafter there would have been no local conditions or obstacles which would not have been overcome to enable the community to construct and operate its own water plant.

The reader may judge that this assertion is somewhat overdrawn; let him stop to consider the major opinion in any city of his intimate knowledge where the waterworks is owned and operated by private capital; does he not, when the opportunity for discussion arises, find the wish expressed that the city owned the plant?

There are few engineers in the United States who make a specialty of designing water plants who have not repeatedly been called in as experts to settle difficulties existing between the municipalities and owners of the waterworks arising from inefficient service, and the writer is unacquainted with the opinions of any such engineer which differs from his own.

Let us for a moment discuss the first installation of a private water supply; and our members who represent a large city must not flatter themselves that they are not of it, because all such cities discussed this subject while in their infancy, as all public water supplies were installed when the present city was a village, town or borough. A committee of prominent citizens, who are usually gifted with more foresight than their associates, combine to have a public water supply installed; a public meeting is called and the question discussed, and thus the scheme is publicly advertised. A bright promoter "catches on," visits the town, learns of its possibilities, and approaches the committee of good citizens with these time worn arguments: "That the construction of the waterworks will cost the town a lot of trouble and money, both of which they can ill afford to spend; that there will be so few water takers for several years that the interest on the bonds cannot be met without very materially increasing the tax rate; that the operation of the plant must necessarily become a political issue and as such will cost much more to operate than it would under private ownership; and that if the town will simply grant him a franchise it will not cost it a cent except the paltry sum of $20.00 to $40.00 per year for each fire plug for fire protection"; all of which must be confessed, are very attractive arguments to the committee, no member of which has ever been up against the same problem before, and in 661 cases out of 1,437, these arguments have been able to carry the day.

The town authorities who are so anxious to get the water and so thankful to get it without cost, grant such a franchise as has been prepared by the promoter himself, or his bright attorney, throwing around it but few restrictions and little protection, with the possible exception of fixing a maximum rate both for public and domestic consumption, which rate is usually suggested by the promoter himself, who is necessarily much more familiar with his busines than the committee is with theirs.

The next step is for the promoter to organize his company, issue say fifty thousand dollars of bonds bearing interest at the rate of five per centum and selling them for eighty-five, from which he secures $42,500.00, which builds the plant and leaves a fund of $5,000.00 remaining for the first two years' fixed expenses. But he does not stop there; he issues $50,000.00 worth of stock, forty per centum of which he gives away with the bonds as a stock bonus, and puts the other sixty per centum in his pocket. in order to retain the control of his company and to pay him for his time and trouble.

The plant is built, and usually in a good substantial manner, but it must be operated for two purposes; first, to meet the annual interest on the bonds, which is $2,500.00, and to provide a sinking fund of $1,000.00 annually to redeem the thirty year bonds; and second, to pay a neat dividend on the fifty thousand dollars worth of stock, for without the latter result, all the work of the organizer would be gratuitous. In other words, the public becomes the third consideration, with the result that in order to accomplish the first two objects purity of water supplied will be sacrificed, quantity of water for fire protection will be reduced, thus requiring insurance rates to be increased. The distribution system will not be extended to meet the growth of the town; that is, a water main will not be extended in a street until there is sufficient "takers" to pay for such extension; in fact the whole service is far behind the needs of the growing town; then comes the time when the town wants to own and control the waterworks, but, alas, the conditions are not now the same as they were in the beginning of this history. The natural growth of the town has required large expenditures for sewers and street improvements, school houses and other public buildings, and the limit of indebtedness has almost been reached; too near, in fact to raise the enormous sum which the owners of the waterworks ask for their property, which, to quote the Pennsylvania law, is "the first cost, plus cost of extensions and maintenance, plus ten per centum per annum on same, less such dividends on common stock as may have been declared, and how many cities, which have now grown from towns, could afford to pay the price? Absolutely none, and so they must continue to bear the burden caused by their first mistake.

Now let us see how much of a mistake this was financially. As stated in the illustration there were issued $50,000.00 of bonds and $50,000.00 of stock; the former at five per centum, and the latter at six per centum, represents earnings of $5,500.00 per year, from a plant which originally cost $37,500.00. If the town had built it the cost would have been no more and the annual earnings for interest would have to be

$1,875.00, a difference in favor of town ownership of $3,625.00, which capitalized at five per centum, represents $72,500.00, which is the actual money gain in favor of town ownership in this transaction, with no consideration for the difference to be annually received for the sinking fund, but the actual gain far exceeds this. For instance, if the quality or quantity of water is not what it should be the people have but to say the word through their vote and it is made so, and as was said in the beginning of this paper, there is nothing which so nearly effects the health, prosperity and comfort of a community as its water supply; therefore the people will vote all right.

Nor is this the only gain as there is another phase of this subject which is of vital importance to the taxpayer, and that is the "annual water bill," which is usually much greater when the water is being supplied by a private company than when supplied by the public corporation. To quote one instance, which is a fair illustration of a number of others which have come under the observation of the writer, the city of Chester, Pa., is being supplied with water by a company called the New Chester Water Company; the annual charges to a house owner having kitchen sink, outside hopper, washpan, bathtub, stationary washstand and water closet is $21.50, and the charges to the city for use of fire plugs is $40.00 per year. The city of Wilmington, fourteen miles away, owns its own waterworks, and the annual charges to the house owner for the same service as enumerated above is $13.00, and no charge is made for the use of fire plugs, and yet the latter city earns from $25,000.00 to $80,000.00 as an annual surplus above its fixed expenses. In other words, if the community owns its own plant it can make money out of it and so realize the benefits by either cutting down the annual water bills to a point sufficient to pay fixed expenses, or by turning over the surplus to keep down the tax rate for general town and city purposes.

It has been proclaimed from the house tops, figuratively speaking, that the municipal ownership of the waterworks means political control which further means extravagant management, and it may be truly said that this is in a measure correct, but only in a small measure. The writer's observation has been that the best and most progressive management of waterworks has been under municipal control; as to economical operation, there is no other way of comparison, because while the cost of operation of a municipal waterworks is open to all who can read, that of private ownership is never known outside of the directors' chamber. But, be the result what it may, if the people own the plant and it is operated extravagantly, it is their own fault and they have the remedy, but if it is owned by a private corporation and is operated niggardly, what have the people to say about it?

The writer is by no means a Socialist, but it is his best judgment that the public should absolutely own and control its own water supply and sewerage system, and he further believes that it is our duty as municipal officers, either past or present, to take every honorable means of informing the municipal officers of less experience throughout this country of the mistake made in giving away such valuable considerations.

MR. FOLWELL: I agree most thoroughly with Mr. Hatton as to the advisability of municipalities owning their own water plants. As Mr. Hatton states, the time often comes when the municipality cannot construct a plant without exceeding its tax limit. There may be other good and substantial reasons why the municipality cannot or does not wish to construct its own plant. The picture he has drawn is not a fanciful one in a great many instances. It is only fair to say to those who are in towns and villages that there is a half-way measure between these two that may be adopted. I happen to live in a city where the plant is owned by a private water company, but nothing is paid by the city for the use of the fire hydrants. The citizens pay $21 in Chester, and $18 in the city I speak of. The plant is run as nearly as you could expect for the benefit of the citizens as far as the sanitary conditions of the water is concerned, and in other respects. While the plant cost $500,000, there are only $5,000 of bonds that have ever been issued on the plant. The interest paid on the stock is not excessive. and the $500,000 represents money actually put into the plant. If the city cannot build a plant, we have here a fairly good instance of what can be done. This is not a case of promoters coming into town; it is a case of the citizens wishing to benefit the town.

The citizens themselves formed a company and built the plant. The citizens of that town are more or less noted for their desire to keep down expenses, both personal and city. They offer a very considerable inducement to those they wish to obtain as citizens, the fact that their taxes are very low. In several small towns that desire to grow rapidly the citizens have themselves combined and formed stock companies and built their own waterworks plants. The tax rate is kept down and there is that advantage they can offer to prospective residents in their towns.

In none of the plants I speak of do the undesirable features Mr. Hatton mentions exist. I desire to say this because there are some here who are concerned, either as engineers or as citizens of small towns, who have the problem still before them, and suggest this as a plan that has at times given very favorable results.

MR. SHERRERD: While I agree almost entirely with the paper, I think that the method of constructing waterworks in the towns where the limit of indebtedness does not allow it to be done, as suggested by Mr. Folwell, could be supplemented by a condition in the franchise under which the town can buy the plant at the end of a stated period. If a town is well advised at the time it enters into a contract of this kind it can be very carefully safeguarded and obtain a better plant sometimes than if it builds the waterworks plant itself.

I have in mind now a small town that is thinking of putting in waterworks. Their limit of indebtedness is so nearly reached that while they want to own the plant they are inclined to put in a meagre one that will not be adequate for the future needs of the town. I think there are these exceptions to the general rule that a town should always own its own water supply. If the town is carefully safeguarded it will be of advantage to it to get more capital invested and have the plant constructed in a way that will be more economical for the growth of the town than would otherwise be the case.

MR. HATTON: There is one record I did not add to my paper, because I only got the final tabulated result after the paper was prepared, which I think goes to show more than any other plan the wisdom of a corporation owning its own water plant. Up to date the average charges for the use of water in the municipalities of the United States which own their own water plants is $13.57 per year, whereas the average charges for private corporations owning their own water plants is $18.82. If there is any better argument against private ownership, I don't know it.

MR. REIMER: Possibly it might interest some of the members and get them to feel that at some time in their own states and governments they may have a way whereby a municipality can get control of a water plant which had previously been installed by private enterprise. In New Jersey they have a great many water plants. The law there provides that where a company has been doing business in a place, and the municipality thinks it should own the plant, two courses may be pursued, and either one of them taken advantage of. If one does not prove satisfactory the other can be tried. In the first place, the municipality may apply to the court for commissioners to condemn the plant. The commissioners may hear evidence on both sides, consider it and report their award to the court, leaving it to either side to appeal to a court and put it before a jury. Either side may refuse to accept either the award of the commissioners or the award of the court. But there is one other method. In two cases the municipalities have accomplished the result in another way. We have a law which provides that a municipality having a water plant which is run by private enterprise may build another plant right alongside of it. Although these parties may have the trade and the custom, for the time being, the municipality may take measures to get another supply by installing another plant, and may assess on every twenty-five or thirty or fifty feet right through the whole community a stated amount, and if they choose can give the water to its inhabitants for nothing. The result is that in two instances in the state of New Jersey I know of, that plan has been pursued. In one instance the company gave in. They found they were going to be beaten and took the price offered by the city for the plant. In the other instance it went through two series of trials, and eventually the city decided to build for itself. Then the company came to terms and gave to the city for $350,000 what they at first asked $800,000 for. It may be that some of you gentlemen would like to investigate the laws of your state and see what can be done. Oftentimes a community will not build where a private company will, but the community can take charge of it at any time. If the company will not hear reason, why take hold of them by the throat and squeeze reason out of them.

Mr. Adam: I suppose a city could only build its own plant to compete with the private enterprise if that is provided for in the contract given the private enterprise.

President Ballard: The Secretary has a letter from Mr. McClintock that I should like to have him read.

Boston, Mass., Oct. 1, 1904.

Mr. Ernest Adam, C. E., City Engineer, Newark, N. J.

Dear Sir: I enclose herewith three copies of my address to be delivered on the last day of the meeting of our Society at St. Louis next Thursday. As pressing business engagements prevent my presence at the meeting, you may ask Prof. Folwell or the Secretary to read it for me; but I shall be perfectly satisfied if the address is read by title and appears for the first time in the printed Proceedings of the meeting.

I neglected to bring home from the office the letter informing me of the name and address of the proper parties to whom to send this, so I take the liberty of sending the copies directly to you.

Yours very truly,
JOHN N. McCLINTOCK.

Mr. Rust: I move that the address be accepted and read by title and the request of the writer complied with.

The motion was seconded and carried.

SEWAGE DISPOSAL.

BY JOHN N. M'CLINTOCK, C. E., BOSTON, MASS.

Near the shore of Casco Bay a summer cottage was built last spring. It is situated on a gentle rise of land overlooking a cove and well illustrates the difficulties encountered in an establishment where all modern conveniences are to be found in the house and where there is no natural way to care for the sewage without causing offense. In the case referred to the drainage of the premises is into the cove where sea bathing is permissible, if sewage is not admitted to pollute the water and the shore.

The problem to be solved in sewage disposal for the house was one of importance, because if the cove was polluted with sewage the beauty and attraction of the whole place would be injured.

A septic tank was built towards the shore, one hundred and twenty feet from the house. The six-inch sewer pipe serving the premises was trapped near the house and the sewage was admitted to the tank through a T pipe, one arm of which reached below the surface of the sewage at rest in the tank, while the other arm was connected with the surface of the ground and protected by a pottery screen. The water in the tank stood five feet deep when the tank was full. The tank was oval in shape, held 1,000 gallons, had a common manhole cover, and permitted the sewage to flow out of the tank from a point two feet below the surface.

Sixty feet beyond the tank was a chamber holding 250 gallons with a common Miller 6″ syphon, constructed to automatically discharge the contents of the chamber when full.

One hundred and thirty feet further along towards the beach was a filter of assorted gravel, five feet in depth, thirteen feet long, and ten feet wide, provided with distributing channels of brick and covered with broken stone beneath a layer of loam and sod. The final outlet pipe was carried fifty feet beyond the filter to the neighborhood of the beach.

The ventilation of the system was unique. There was a three-inch vent from the septic tank above the sewage to the sewer beyond the outlet of the tank; a similar vent to the siphon chamber, and the air space above the filter was connected with the under drains and final outlet pipe by means of a vertical pipe and two quarter bends of 6″ pipe in the form of a semicircle with the curve uppermost. By this method the resulting gases formed in the tank were not confined in the system, but escaped through the loam over the filter bed or through the final outlet pipe.

The surface of the ground above the works shows no indications of what is beneath; the manhole covers of the tanks are the only visible evidence of the works.

It is estimated that the septic tank would receive a full capacity of 1,000 gallons of sewage a day; that the siphon chamber would discharge at average intervals of six hours; that the water from the same would cover the filter beds at each discharge to a depth of three inches, and that during the twenty-four hours six and one-half cubic feet of gas would be evolved. If for any cause bacterial action in the tank should cease, and the solid matters accumulated therein, the accumulation solids could be removed, as from an ordinary cesspool. It is estimated, however, that this system will be operative for many years to come, with no attention whatever; that the waste matter consigned to the sewers will be disintegrated in the septic tank; that the effluent received on the filter will be purified, and that the final effluent, entering a small rill, will give no offense in the neighborhood.

As one crosses the Mississippi river over the high bridge at St. Louis he will note the turbid appearance of the Father of Waters due to the silt carried in suspension in the stream. A close view of the surface shows one that the river literally rolls on its onward course toward the gulf—a fact that perhaps makes swimming so difficult and dangerous in its current. In mid-channel the rate of flow may average two miles per hour, in which event water passing St. Louis today would require forty days to reach the mouth of the river.

Undoubtedly if the current came to complete rest for the forty days very much of the silt would be deposited, but at New Orleans and at the Head of the Passes the water seems as fully charged with coloring matter as at St. Louis.

When the current of the river comes to salt water there is a rapid precipitation of all floating matter, giving rise in the course of centuries to the formation of the delta, and forming constantly about each pass a bar of river mud.

The muddy water of the river escaping by mouth and crevasse reaches several miles from the shore of the delta, becoming gradually more and more clarified until all trace of discoloration is lost.

A sewer is a river on a small scale. The one proposed for the Passaic Valley, when built, will be a river of considerable size. The sewage carries in its current silt in the form of particles of organic matter which precipitate when brought into contact with salt water.

It has been found by experiment that the amount of suspended matter in sewage, when the flow is about 100 gallons per capita per day, is about one-half of one per cent. of its bulk; but as organic matter carries about 90 per cent. of water in its composition, the ratio of the suspended matter, or silt, or mud, to the volume of the sewage is as high as three per cent. at times.

It is immaterial whether a population uses 20 or 200 gallons of water per capita per day. The same amount of suspended organic matter per capita is carried in the sewage in any event. Taking the average amount of water per capita used in the country as 100 gallons per day, the suspended matter per capita may amount to three gallons. Allowing that the organic matter loses two-thirds of its contained water by pressure or otherwise, the resulting figure is one gallon per capita per day. In seven and one-half days this may amount to a cubic foot; in six months, to a cubic yard; in a year, to two cubic yards.

To illustrate more fully this proposition, take the 4,000,000 inhabitants dwelling in Greater New York. The drainage and street detritus reaching New York harbor from a population of such magnitude may amount to 8,000,000 cubic yards during the year.

The problem is, what becomes of the vast bulk of solid matter thus carried to the harbor?

The answer has been demonstrated many thousand times; it is precipitated to the bottom near where it meets the salt water.

Nor is that all; the sea water is a pickle, a brine, that arrests decomposition and permits the organic matter to accumulate upon the bottom of the harbor.

Were the matter to be collected in one section of the Hudson during a year, from the surface of the water to the bottom of the river, on the supposition that the river was a mile wide and forty feet deep, it might make an obstruction the full width and depth of the river, 1,000 feet wide; five years might extend the bar a mile; a century might fill the East and North rivers adjoining Manhattan Island; two centuries might carry the obstruction to Staten Island.

It may be possible and probable that it would take more than two centuries to absolutely ruin New York harbor, but it is only a question of time when it would be ruined for commerce or for any other purpose, if the present ruinous policy is not changed.

It is true that the 8,000,000 cubic yards of solid matter may be annually dredged from the harbor; but this vast expense will not be undertaken until it becomes absolutely necessary, or perhaps until the deposit has doubled in quantity.

Much of the solid matter in sewage is of a fatty nature, and does not sink but floats upon the surface, putrefying, and finally lodging upon the shores, especially in evidence between high and low water to all the senses.

There is in sewage, moreover, a function dangerous to life and health; it is classified as bacteria; originating naturally, but unless controlled, carrying danger and death in the most repulsive form to great distances.

The Biblical text, "Cast your bread upon the water, and after many days it will return," according to commentators, relates to the planting of rice seed; but it applies as well to the casting of the seeds of disease and death upon the water in the form of sewage, for after many days it is sure to return, perhaps to wreck a life and happiness of innocent parties.

It may be absorbed by bivalves or fish and ultimately poison a family or community very remote from the place where the crime was committed.

By the proper construction of sewers it is possible to arrest in catch-basins all the heavy mineral matter forming the detritus of the city and to keep it from river or harbor. It is also possible to arrest to a large extent, the organic matters in sewage in so-called septic tanks, and allow it to almost entirely disappear by action of bacteria. By the use of so-called contact bacteria filter beds, it is possible to remove the bacteria from the sewage, after they have served their liquefying function, and permit to flow away a harmless and unobjectionable effluent that will not injure marine life or become a nuisance.

By a series of experiments extending over a period of five years the city of London, England, has demonstrated that satisfactory purification of sewage can in this manner be effected at the rate of 5,000,000 gallons per day upon an acre of land, and the council have voted to adopt the system.

If this amount of sewage is held above the filtering material for a day, instead of passing through, it would mean a depth of fifteen feet.

Applying these figures to New York harbor, which has a shore line of say forty miles, in New York and New Jersey, and four hundred million gallons of sewage to dispose of daily, it means ten million gallons of sewage to each mile of shore line.

According to the London experiments, this sewage can be purified upon two acres per mile of shore line, or in a width of less than seventeen feet.

In other words, the 400,000,000 gallons of sewage of the 4,000,000 inhabitants of the great metropolis of New York can be rendered harmless and inoffensive on 80 acres of land—and there is at least one acre of land good for no other purpose beneath the floor of every pier in the city, the space between high and low water being adapted to no other economical use.

The sewage from New York can be purified in this manner at a very reasonable cost, simply by enlarging the sewers that at present extend to the outer end of the piers; or vast intercepting sewers can be constructed with pumping stations and outfall sewers, and the sewage may be collected for treatment and purification in one or more places in a more or less remote locality. It has long been known that oysters are liable to be poisoned by the bacteria in sewage, and clams are no less susceptible; and more recently fish have been found tainted with disease germs. Unless fish and oysters are eliminated from our tables, they should not be rendered unsafe or even suspicious as an article of diet.

The question is frequently asked how long bacteria will retain vitality and power of injury? It may be answered generally with the statement that they survive while putrefaction continues—it may be fourteen days, or for fifty days, or their vitality may be suspended indefinitely. Thus, if carrion is cast upon the water, it will not cease to be dangerous until it is entirely decomposed and disintegrated. It may carry its poison two hundred miles or two thousand miles. In a septic tank this disintegration may take place in ten days or in fifty days; the poison is there until the organic matter is decomposed, and only the clarified effluent escapes from the system.

There arises in a congested civilized community the problem of how to dispose of the waste matters to the best advantage. The engineer is called upon to solve the problem. A maritime city has its beginnings about some commodious harbor inviting commerce. If it is found that the harbor is an improper place to deposit the waste matters of the city without serious injury to the harbor itself, its marine life, and the health of the inhabitants living thereabouts, some other method of sewage disposal than so-called dilution must be adopted. This should be a self-evident proposition, and not necessary to be argued.

In the case of fresh water rivers and lakes, the conditions are somewhat different; decomposition is not chemically retarded by the constituents of the water; but on the other hand the bacteria are afforded a better opportunity to propogate and to become dispersed.

What shall be said of the city that discharges bacteria-burdened sewage into the reservoir or lake from which its water supply must be drawn, or into a river from which the water supply of a sister city must be drawn? Today this is not the exception, but the rule throughout this country.

As members of the American Society of Municipal Improvements, I would ask you the question: "Is there a municipal improvement of more importance than the proper disposal of sewage and the purification of water?

I believe it is possible with our present knowlege of Zymotic diseases to stamp them out absolutely from every civilized community. The bacteria of disease are enemies minute in size but of dread power and fearful potency. They do their work stealthily but effectively. They are foes of our race worthy of the most serious consideration and are to be met and combated by all the resources of science and experience.

It seemed at one time that the advent of water borne sewage in a community, while undoubtedly a convenience, only served to more widely spread abroad disease germs; but later developments in our knowledge of sewer construction make it possible to correct this fault, and to collect all waste matter and harmful bacteria in the sewers, and thereby carry them to the septic tank and filters, wherein they may be eliminated.

If sewage is retained from 12 to 36 hours in a septic tank with a depth of five feet or more, provision being made for resulting gases, and the effluent is emitted in such a manner as not to disturb the surface of the sewage at rest, there results a bacterial breaking up of organic matter more or less extensive. If the effluent from the tank be thoroughly oxidized in a filter bed, the final effluent is rendered harmless. It is immaterial whether the most purification takes place in the septic tank or in the filter as long as it is brought about in one or the other place. Supposing that sludge accumulates in the septic tank, it is good practice to so build the tank that sludge can be removed in any event. If the filter becomes clogged, that fault can be corrected. So it is the best practice to build the tanks and filters in series, so that alterations and repairs may be made without interfering with the action of the system as a whole.

This system applies equally well to the summer cottage on the shore of Cesco Bay, and to the largest city in the land, draining into the seashore harbors, into one of the great lakes, or into any one of the rivers of the land.

Mr. Hatton: I prepared a paper for Mr. Adam which I am perfectly willing to have read by title. I promised him I would prepare a paper on "Sewerage Disposal." As it is growing late I think it might be referred to the Secretary.

On motion, the paper referred to by Mr. Hatton, was read by title and referred to Secretary Tillson.

SEWERAGE DISPOSAL AS APPLIED TO SMALL CITIES AND TOWNS.

BY T. CHALKLEY HATTON, OF WILMINGTON, DEL.

The rapid installation of public water supplies for small cities and towns throughout the United States has during the last decade been very marked and in those places in which the water system has long been installed, the patrons, since 1895, have increased over 37 per centum, owing no doubt, to a more progressive age which has apparently swept over our entire country. The tenant at ten dollars per month is now just as anxious to enjoy the comforts derived from a public water supply, such as kitchen sinks, bath rooms and inside water closets, as the tenant at fifty dollars per month has ever been. This has resulted in enormously increasing the amount of water used for all purposes in the smaller cities and towns and forced upon the communities the grave necessity of providing some means by which this water, after being soiled, could be carried off under ground and so disposed of as not to be a menace to the health of the communities. Thus sewers and sewerage systems have become a necessity to the smaller cities and towns just as they have always been to their larger sisters. Now some of these communities are fortunately situated upon the shores of a river of some importance, and can dispose of their sewage by discharging it direct into the river, but the majority are located upon the banks of a small stream, which during the dry season of the year, possibly five to seven months, contains but little water, with a low velocity of flow. This stream most frequently, after passing through the town, flows through an agricultural community, by whom the water is used for watering the stock, and by towns in which this same water is used for domestic purposes, so that while the upper town has gotten rid of its own sewage, it has endangered the health of all those riparian owners to this stream below it.

Many of the members of this Association are familiar with just this condition, and it has impressed itself so strongly upon the public at large that laws have already been passed in many states prohibiting the pollution of inland waterways. Massachusetts was the pioneer state to pass such laws, and placed the purity of the state streams in the hands of the State Board of Health. Connecticut, New York, New Jersey and Pennsylvania have also passed regulating laws, although the latter state has been very mild, probably owing to its enormous mining interests which would be terribly handicapped if a stringent non-pollution law was enacted and enforced, as under the present system of mining hard coal, the refuse from the washeries must reach the nearest water course and so pollute it as to render its waters unfit for either man or beast.

The National Board of Health has long considered stream pollution, and has through many papers written by its members, brought the matter to the attention of Congress. In fact the trend of public opinion is unquestionably towards keeping God's streams as pure as possible.

In Massachusetts, Connecticut, New York and New Jersey the laws provide that no community may build a sewerage system without it first has the approval of the State Board of Health upon the question of disposal, and while the operation of these laws is, in some instances, somewhat of a farce, yet it is all tending rapidly in the right direction; that is, that we cannot endanger our neighbors in their alienable right to the purity of the water in a stream which runs through or over their property.

Again, there are many small cities and towns so located as to have no water course of any magnitude running within their boundaries, and the question of disposing of the sewage here becomes a very grave problem. The writer is now engaged by such a city to design disposal works which will insure a purity of effluent equal to the waters of a mountainous stream to which the city has no riparian rights, and so far the problem has proven a very difficult one.

Admitting then that what has been previously written is a fair and true statement of the facts and that the question of the disposal of its sewage is becoming an urgent one to be considered by the officers of the small cities and towns it becomes the duty of the American Society of Municipal Improvements to thoroughly discuss the subject, and to thus give the public such information upon the subject as its members may have.

To begin with the writer very frankly admits that the conscientious city or town board, whose duty it becomes to decide upon the best system of sewage disposal for its conditions, has a hard problem before it because the satisfactory disposal of sewage is in a purely experimental stage both in this country and abroad.

Broad irrigation, sub-surface and surface irrigation, intermittent land filtration, land disposal, chemical precipitation, septic treatment, bacterial treatment by simple and double contact beds, intermittent sand filtration with aeration, mechanical separation and electrical treatment have all been tried with more or less success in this country, but the writer has never, with few exceptions, seen any of the above systems used with entire satisfaction, and he believes he has seen most of the principal systems in this country. The few exceptions noted as being satisfactory consist of plants, which have been thoroughly studied out by competent engineers, assisted by natural local conditions and agencies which can rarely be found, and the maintenance of such plants has remained in the hands of interested and competent men.

Many of the irrigation systems which have been built with great care, have been allowed to become almost useless from want of intelligent operation and extension. In intermittent land filtration plants which the writer has visited, he has found many of the under drains effectually stopped up, and the land so overdosed as to preclude the possibility of purification except in name. In chemical precipitation plants, with two exceptions, the operation of the plant has been intrusted to the hands of such incompetent men that no record of the amount of purification is kept or known, the sewage being dosed with the same strength of chemicals at all stages of the day regardless of the strength of the sewage, and this has proven such an expensive system, for this reason, that it is rarely now recommended by engineers, and has in fact been abandoned in some places where it has been installed at large expense. But of all the systems which have been installed the greatest numbers of failures has probably been in septic tanks, and septic treatment.

This treatment has proven a very popular one by reason of its extremely low cost of installation and operation when compared with any other system, and several parties have patented certain devices attached to septic tanks, and have employed bright men to introduce these devices to the officers of the smaller cities and towns to whom they have claimed such successes for their treatment that large numbers of these systems have been installed without regard to the peculiar conditions existing in the several places. They argue that what is good enough for one place will answer equally well for another, regardless of the well known fact that the sewage from one community is rarely the same as that from another, frequently because one contains the liquid refuse matter from an industrial establishment that is foreign to the other, and thus needs entirely different treatment. The employee of such patentee gives this advice and information to these communities free, whereas the employment of an unprejudiced but competent engineer, from whom such advice could be obtained, comes high, and thus septic treatment of sewage has become a system to be looked upon with suspicion.

The writer has in the last few years examined many plants built at considerable expense, upon which the effluent is being discharged no purer than the influent although somewhat clearer; the latter quality has closed the eyes of those interested in obtaining a pure effluent and thus far has answered the purpose for which the plant was constructed.

Now it is not the writer's purpose to condemn septic treatment, nor is it his purpose in this paper to recommend any special treatment of sewage, but to broadly discuss the subject and endeavor to lead those interested in purifying sewage to undertake the proper preliminaries to obtain this end. And it may be well right here to briefly, and without technicality, outline the several systems of sewerage purification commonly used in this country. Broad irrigation should, in the writer's opinion, be considered of first importance as a method of sewerage disposal for small cities and towns because its principles are in the line of utilizing the waste products of the body for the growth of those products of the soil which maintain the body, thus following the law of creation "that nothing shall be lost."

Broad irrigation is a system by which the manurial products of the sewerage is used to enrich the soil. The land to be treated should be located upon a gently sloping hill, and laid out in furrows around the hill, each furrow to be placed one above the other, similar to the manner of preparing ground for planting cotton, except that the furrows are placed several feet apart, such space to be adjusted according to the porosity of the soil, and each furrow to be at the same elevation throughout its length. These furrows are termed carriers, and under the ground at a depth of from 3 to 5 feet, according to the nature of the sub-soil, tiles are laid nearly at right angles to the furrows and to a collecting drain at the lower end of the field, this drain being connected with the nearest available ditch or water course. In brief, this is the manner of laying out the field. The sewage is brought to the top of the field either by gravity or by pumping from the city or town to be sewered, and by a system of gates built into a sewer carried down the center of the field at right angles to the furrows; it is allowed to discharge into these furrows, one after the other, until each furrow has all it can hold, when another tract prepared as the first one is dosed. The sewage is absorbed by the land. A proportion of the liquid reaching the under drain through which it is carried to the ditch or water course, and if the field is properly worked the effluent thus discharged into the ditch or water course may be rendered harmless. The crops are grown both upon the edges of the furrows and upon the space left between them; they grow very rapidly and where the conditions are favorable, can be made to pay for the cost of operation. With ground fairly well located and of good texture the sewage from 65 persons can be thus treated upon one acre of ground which can be prepared at a cost of approximately $1,250.00. Unfortunately this system of sewage treatment cannot be used with advantage in the middle or northern sections of the United States because there are several months in the year when the temperature is too low for growing crops, but in the southern sections the crops can be made to rotate constantly upon these irrigating fields, especially tobacco, rice and small truck, and the soil in many portions of the Gulf states is particularly well adapted to broad irrigation, and large tracts of ground are available close to many of the cities and towns.

Sub-surface irrigation consists of laying lines of small tile a few inches under the surface of the ground to be irrigated, the joints at the sides of the tile are left slightly open so that the liquid can escape into the ground, and a few feet under the ground, under drains are laid to the nearest water course. The sewage is brought to the field in the sewer leading from the town; is discharged into the upper tiles, from whence it finds its way into the ground just below the surface and is thus taken up by the roots of the growing crops, the remainder sinking through the ground to the under drains below through which it is carried to the nearest water course, and this effluent may be made practically pure if the field is not overworked. This system has some advantage over broad irrigation inasmuch as the surface of the ground is smooth and the crops can be easily planted and harvested in the usual manner. The sewage from 100 or 200 persons can thus be treated on one acre of ground but the latter must be fairly porous and must not contain stratas of heavy clay above the under drains. The cost of preparing an acre of such ground would probably be $1,600.00. This system can be used in a somewhat colder climate than broad irrigation, but must or should be confined to localities where frost does not penetrate for any length of time to the depth of the sub-surface tiles.

Surface irrigation has been used but little in the eastern section of this country, although it has been tried with some success in the sandy soils of lower California.

It consists of preparing a sloping tract of ground in a system of ridges from 1′ 6″ to 2′ 0″ in height, which are made of cinders, small stones, gravel or any other available porous material. These ridges are built around the slope and as nearly parallel with each other as the contours of the ground will allow, and at the bottom of the slope a collecting under drain is laid and led to the nearest water course. The sewage is discharged upon the summit of the slope; it covers the first space above the first ridge, passes through the porous material which composes the ridges, which thus stops its velocity of flow and gives the ground time to absorb much of it; the balance flows through the ridge, over the next space and into the second ridge where the ground again absorbs some of the liquid, and so on to the bottom of the slope where it is collected by the under drain and is thus discharged into the water course. The effluent from this system is of doubtful quality because the ground gets very little time to absorb the sewage, and most of the purification is done by oxidization and nitrification taking place in the ridges which give the bacteria good opportunities for work.

The writer has met with a few localities where this system would admirably answer all conditions. The construction and operation of the system is very cheap and it can doubtless be used to great advantage in many localities where a high standard of purity for the effluent is not sought. Intermittent land filtration is one of the popular systems of sewerage disposal, and is probably the most successful system used at present in this country. It consists of preparing a reasonably level tract of ground in level beds of from one-half to two acres in area, surrounding each with low earth embankments so that each may be entirely separated from its neighbor. Laying under drains under each bed from 3 to 5 feet in depth and from 20 to 50 feet apart, according to the porosity of the ground, connecting these with a main collector at one end of the bed, and leading this collector to the nearest water course. The sewage is brought to the fields in the sewer, which has connection with each bed. Bed number 1 is first dosed with a sufficient volume of sewage to cover its surface to a depth of from 6 to 12 inches, when the sewage is turned into bed number 2, and the sewage in the first bed is allowed to settle through the ground slowly to the under drain below; in its travels it is purified by the work of the myriads of colonies of bacteria existing upon and near the surface of the bed and contained within the sewage, and the effluent reaches the under drain almost pure enough to drink. The bed is then given a period of rest from two to six hours, which is necessary to give the bacteria time to recover from their excessive labors and to thoroughly aerate the beds; that is, give the beds time to absorb oxygen. To operate this system successfully the ground must be free from heavy non-porous clay, a mixture of clay and sand or gravel in the proportion of 3 to 1 is about a limit. One man is all that is necessary to take care of 15 to 20 acres of beds, except in harvesting the grass which grows upon the surface of the beds. The cost of construction runs from $500.00 to $2,500.00 an acre and each acre can care for the sewage from 1,800 persons providing a surplus area of one-half acre is provided to give the needed rest to the acre of beds. In fact should a population of 1,800 persons only be considered, it would be necessary to practically double the area for such a limited population. The rate of 1,800 to the acre is included as a limit.

Intermittent land filtration is applicable in a majority of places in this country. Temperature has little effect upon its operation and the proper quality of land is most frequently available. Its results are more uniformly satisfactory than any other system, partly because it requires a lower standard of intelligence to properly operate it than any other system, and while it is expensive to construct, it requires a limited area of ground, and is operated for almost nothing; in fact its numerous advantages over other systems recommend its wide use throughout this country.

Land disposal is a system of discharging the sewage upon broad areas of fairly porous ground at intervals for the purpose of inducing the growth of crops. There is no under draining resorted to, but the ground is expected to absorb all the sewage and liquid discharged upon it. The system is applicable to but few localities in this country. It requires great areas of land, which must be light sandy soil, qualities which are rarely available within reasonable distance of any city or town. Besides the people of this country are in a habit of using such a large quantity of water for domestic purposes that the proportion of manurial products is small when compared with the large volume of water discharged upon the land. The system should be popular and a self-supporting one in the arid sections of this country, but could not be introduced with success in sections elsewhere.

Chemical precipitation is a system which took fast hold of this country some 15 years ago, and consists of injecting into the sewage some precipitating chemical, such as sulphate of alumina, lime or oxide of iron, after which the sewage is retained for several hours in water-tight compartments or beds to allow the chemical to perform the work of separating the solids held in the solution of the sewage and carrying them to the bottom of the tanks in the form of mud or sludge. It is claimed for this system that the solids thus settling in floccuent masses catch and hold the harmful bacteria contained in the sewage and they are thus carried to the bottom. The effluent from these compartments or beds is sometimes discharged upon intermittent filtration beds, sometimes upon broad irrigating lands and sometimes directly into the nearest water course. The sludge is gathered up from the bottom of the tanks either by a sludge pump or by hand, and burnt or made into a compost. When the effluent has been directly discharged into the water course without further treatment it has not heretofore been possible to obtain a very high standard of purity.

The system is not only an expensive one to construct, but it has been found a very expensive one to operate. The cost of the chemicals used becomes a large factor in the expense, and the disposal of the sludge has proven to be a troublesome item. It was at first thought that this sludge would prove of commercial value to the farmer, but this has not been the case, and it has been burned with much expense. One of the worst features of this system is the great care necessary to successfully operate it. It requires professional men about it at all times to test the influent and effluent and thus determine the amount of chemicals necessary, as the strength and quality of the sewage changes hourly throughout the day. In some places where this system has been adopted the authorities felt the service of these professional men were too expensive and have put their work in the hands of unskilled men, with the result that the effluent is not satisfactory and the cost of the chemicals has been enormously increased. If fact the system can hardly be recommended for adoption to small cities and towns.

Septic treatment consists of discharging the sewage into either closed or opened water tight compartments large enough to permit of the sewage lying within the compartment in a quiescent state for a certain period of time from two to four hours, according to experiment.

It is claimed that during this time the nitrifying influences, or work of the colonies of bacteria contained in the sewage, purifies it and results in a reasonably pure effluent without further treatment. There are various devices in the market which are introduced in and about the installation of septic tanks, such as aerators, for which the patentees claim merit, and no doubt these claims have been substantiated in numerous instances, but it is the writer's judgment that a septic tank treatment is not the "cure for all ills," nor is it applicable to all cases as is so frequently claimed. The builder loses sight of one very important point which has heretofore been mentioned, that the strength and quality of the sewage from any community varies hourly, and yet a septic tank is constructed to purify automatically every kind of sewage in the same way and during the same period of time, which is a practical impossibility, that is, if the same standard of purity is to be maintained.

When the local conditions do not warrant a uniform standard of purity, or a high standard, the septic tank in many cases is just what the small city or town should adopt. Its installation is very cheap when compared with the cost of the other systems mentioned herein, and its cost of operation is practically nothing, and these are the two points which have made the septic tank so popular in this country. There is no denying the fact that the community will rest easy and sleep well if they feel that their sewage, or the sewage of their neighbors further up the stream, is being purified, they little question what standard of purity is being maintained.

Bacterial treatment by single and double contact beds consists of discharging the crude sewage upon prepared beds of clinker, cinders, coal culm, crushed stones or some other equally porous material.

The beds are made from 3 to 7 feet in thickness. The sewage is retained in the beds to a depth of from 6 to 15 inches above the top of the filtering material for a period of from one to three hours, during which time a certain amount of purification has resulted from aeration and the work of the bacteria contained in the sewage. The effluent is then discharged into the water course or upon a lower and similarly prepared bed of somewhat finer material, where it goes through the same process. The beds are allowed to rest for several hours between doses so that they can become thoroughly aerated and the bacteria can properly digest the food they have taken. This system has just been introduced into this country and has proven fairly successful where a high standard of purity is not required. Its construction and operation can be reduced to a small cost; the first by using earth embankments about the beds, and the latter by the use of automatic syphons by which the beds can be discharged at stated periods without any attendance. The system seems particularly well adapted for small cities and towns for several reasons, among which may be named the low cost of installation and operation, the uniform standard of effluent obtained, lack of any attendance, which in the case of small communities is so difficult to obtain of a trustworthy kind, and the absence of any offensive odors from the beds so that they can be located in proximity to dwellings without nuisance. No special kind of soil is demanded, and the filtering materials are nearly always available. Two acres of double contact beds can satisfactorily treat the sewage from a population of possibly 4,000 persons, leaving one-fourth out of use for emergencies, and the cost per acre for construction depends largely upon the cost of the securing and transporting of filtering materials.

Intermittent sand filtration combined with aeration and mechanical separation may be placed in the same class as they act in much the same way. The beds are usually placed at some elevation above the ground or collecting channels, and consist of fine sand, charcoal or coal culm, upon which the sewage is discharged, either intermittently or continuously. The sewage and water pass through these beds and drop through the air to the collecting channels below. So far this system has not secured a standard of effluent which would commend itself to communities where even a reasonable standard of purity was required. It is somewhat difficult to operate in cold climates owing to the ice forming around the collecting channels and about the plant; the wind carries the drops of water, as they fall from the bed, outside of the collecting channels and scatters it broadcast in the vicinity of the filters.

Electrical treatment has been but little used in this country, but consists of injecting into the sewage a solution of salt water which has been subjected to an electric current; what purification takes place the writer is unable to state as he has never seen the record of any analysis taken of the influent and effluent.

A large number of sewerage disposal plants, as they are now operated, are a combination of two or more systems herein briefly described, even the much advertised septic treatment is frequently combined with intermittent land filtration, contact beds or surface irrigation. But all the systems, with the possible exception of chemical precipitation and electrical treatment, depend upon the micro-organisms contained in the sewage itself, and in the material with which the sewage comes in contact, to induce putrefaction and the final destruction of harmful organic substances to harmless ones, and the judgment of the engineer in designing the disposal plant is exercised best in determining the most available and best adapted media for the protection, propogation and life of these desirable and absolutely necessary micro-organisms.

It is the writer's experience that in considering the question of sewage disposal for any community it will likely prove fatal to proceed upon the plan that what proved successful for one place will prove equally so for another, because the quality of sewage is rarely alike owing frequently to the presence of a mineral product in the water supply of one town that is entirely foreign to that of another; also to the liquid refuse from an industrial establishment in one place of which there is nothing similar in another; or the water is used in larger volumes per capita in one city than in another, and many other causes which will effect the question. Also the availability of the natural filtering media, is as much to be considered as is the question of cost of construction and operation; in fact these three questions are interdependent, but it has proven invariably true that there are always predominating reasons why the judgment of the engineer determines upon one of the plans outlined in this paper as best suited to all the conditions, unless he is prejudiced in favor of some special system, or unless he has a device to sell; in either case he is a very unsafe advisor for any community.

There is no community who need become alarmed for the future of its sewage; it can be safely disposed of by some system; the serious problem is to determine the best, but it is hoped that all communities will consider this question very seriously and may in the very near future arrive at the same conclusions which were reached by the Commission of Sewage of Towns of England, as far back as 1858, which the writer in closing this paper quotes in full as summing up the question as well today as it did 45 years ago.

"That the increasing pollution of the rivers and streams of the country is an evil of national importance which urgently demands the application of remedial measures; that the discharge of sewage and of the noxious refuse of factories into them is a source of nuisance and danger to health; that it acts injuriously not only on the locality where is occurs, but also upon the population of the districts through which the polluted streams flow; that it poisons the water which in many cases forms the sole supply of the population for all purposes, including drinking; that it destroys the fish, and generally that it impairs the value and the natural advantages derived from rivers and streams of waters.

"That this evil has largely increased with the growing cleanliness and internal improvements of towns as regards water supply and drainage; that its increase will continue to be in direct proportion to such improvements, and that as these improvements are yet very partial, the nuisance of sewage, already very sensibly felt, is extremely slight as compared to what it will become when sewage and drainage works have been carried into full effect.

"That in many towns measures for improved water supply and drainage are retarded from the difficulties of disposing of the increased sewage which results from them; that the law which regulates the rights of outfall is in an anomatous and undefined condition; that judicial decisions of a conflicting character have been arrived at in different instances, and that consequently the authorities of towns have constantly before them the fear of harassing litigation."

The writer does not wish to be understood as advancing any new or original matter in the description of the various systems of sewerage disposal but to simply condense a brief description of all the well known systems in such a small space that their general character could be easily comprehended by the members of this Society, even though he is an entire novice to the subject, although it must be true that there is not a member of the Society who has not at some time been interested in this subject sufficiently to have given it some serious study and consideration, even in a general way, and who is not able to add his mite to the general information which is now so much demanded by the general public, and the writer hopes that every member will feel warranted in publicly discussing the subject.

THE BITULITHIC PAVEMENT.

BY F. J. WARREN, BOSTON, MASS.

We are not ordinarily inclined to appreciate the tremendous advances which have been made in road building during the past century. When we drive over and observe the many advantageous features of macadam, brick, asphalt or the wood block pavement, we do not appreciate that such roads were not available at all at the beginning of the last century and that the entire development in road building started in as late as 1816 with the introduction of the macadam road by the eminent English engineer, John McAdam.

It is, I think, generally conceded that a dirt road, when in perfect condition, when neither too dry or too wet, is the ideal road for pleasure driving, and that the macadam pavement affords some of the advantages of the dirt road and overcomes many of its disadvantages, and is the most generally used street of the present day throughout all sections of the world. Stone, block, asphalt, brick and wood, all have some advantages not possessed by the macadam, and other disadvantages. No pavement is ideal and the public never has and probably never will believe that any pavement is perfect.

In the bitulithic pavement the effort was made to retain the advantages of the macadam pavement to the greatest possible extent; retain all of its good features and overcome so far as possible the tremendous tendency to ravel and wash and grind under traffic. The method of accomplishing this end has been fully explained in previous papers before this and other societies, and it is encouraging to the originators of the idea that the public has accepted the pavement as an advance in the right direction. Briefly, the fundamental principles in the construction are that the sub-foundation shall be thoroughly rolled with heavier rollers than are ordinarily used in roadway construction and that the foundation shall be equally well-compacted by rolling. The hardest available stone should be used in the wearing surface and the stone after being crushed should be used in predetermined proportions, and that by using crushed stone in predetermined proportions and binding it together with a scientifically prepared bituminous cement, great durability can be accomplished, and at the same time there will be retained to the wearing surface the advantages of a first class macadam road, and overcome many of the disadvantages of other pavements. The laying of a few sample pavements of this class in 1901 attracted considerable attention and the following table indicates the development which has taken place since that time:

STATISTICS OF LAYING OF BITULITHIC PAVEMENT.

Year.	No. Cities.	Total Area Square Yards.	Average Area Per City.
1901..................	7	16,400	2,343
1902..................	33	365,932	11,090
1903..................	40	800,071	20,000
To Sept. 1, 1904.......	47	1,222,435	26,009

The advantages of the pavement may be best set forth by quoting from the report of a committee from the city of Cincinnati which recently investigated a large number of pavements through New York and New England.

The chief features to commend this pavement are:

First. Its freedom from mud and dust. The surface can be sprinkled, swept and kept entirely free from dust. If free from dust, and no attrition of the surface taking place, rain cannot produce mud.

Second. Absence of any slippery surface. When wet the surface seems just as good holding as the surface of a new macadam road.

There could be no side slip for bicycles or "skidding" of automobiles on this pavement. This eliminates a very dangerous condition, which is the frequent cause of accidents on some other forms of pavement. Wet rubber tires get a good grip on the surface.

Third. No evidence of cracking. From the ductility of the surface and manner of construction, it would seem very unlikely the surface could crack or break up.

Fourth. Durability. The streets inspected showed no evidence whatever of wear, washing out or breaking up. From the manner of construction it would be fair to suppose the durability is all that could be desired.

Fifth. Although the pavement is firm and non-wearing, it is not at all a "dead" surface. Horses travel freely and comfortably over it. There is a sufficient yield to the surface to prevent any injury to the hoofs or tendons of horses habitually using the pavement. Rubber tires travel quickly over it. It is a comfortable pavement to use for any kind of vehicles. Your committee had the pleasure of traveling in one day over one hundred miles in autos over the larger part of this kind of pavement.

Sixth. The surface affording a good foothold for horses, and "lively," makes the traction of heavy loads considerably easier for horses. Rubber tires, securing a grip on the slightly roughened surface, allow all power in any automobile to be used for propulsion, as is also the case with bicycles.

Seventh. The surface can be swept and kept perfectly clean, and at any time it can be flooded and washed without any inconvenience. Being waterproof, noxious substances thrown on the pavement cannot be absorbed.

Eighth. The color of the surface is a dull gray, very restful and pleasant to the eye and not at all likely to radiate heat. It presents a well-finished, well-kept appearance.

Ninth. No crosswalks are needed. The street being free from mud and dust, the pavement is suitable for the pedestrians as well as for any form of locomotion.

Tenth. Simplicity of construction. The pavement can be laid from curb to curb without the use of gutter stones. No "toothings" along the car rails are necessary. The pavement is laid flush with the improved grooved car rails. No headers are use at its junction with any other form of pavement, but headers can be used where car rails are laid in streets if it is deemed advisable by the engineer.

Eleventh. The street is easy to repair. In case of street opening being necessary, the pavement is easily removed and replaced, and if properly rolled, very little evidence of replacement is left.

Twelfth. Its noiselessness. Horses' hoofs make but very little sound on the pavement, vehicular traffic none at all, unless from the nature of the load.

Thirteenth. It can be laid over the ordinary macadam road or any other pavement, after the usual preparation and change. It can be quickly laid in sections, and is at once ready for use, entailing very little interference with traffic conditions.

Fourteenth. Cost. This compares very favorably with any of the pavements now being used in our city, and we believe is very much less than has been paid heretofore for some of the pavements now in use.

The construction of the pavement seems very simple and even the originator of it did not realize at the start all of the possible causes of defects and the care which was necessary to avoid them. Having considerable experience, however, in the manufacture and handling of bituminous materials, we recognized that we were overcoming a great many of the causes of defects which generally existed in bitumious pavements. The mixing of stone in predetermined proportions does not necessarily give a good wearing surface, for the proportions might be erroneously combined. For example, if wrong proportions of the various sizes are used, some of the intermediate sizes may act as the basis of a fulcrum and a lever when the bitumen is most flexible in the hotter days of summer, and the heaviest teams might cause a slight movement of the stone which would permit water and dirt to ooze in between the stone particles and give a starting point for future defects. Again, if the mixture is perfectly combined and through carelessness in workmanship is improperly compressed, the same or similar defects might occur. The above defects have been very few in the work which has been constructed because it has been realized by those engaged in the industry that the greatest care should be exercised in the selection of the materials and the construction of the pavement. Other defects could very readily occur from carelessness in the selection of the stone and the use of stone which will grind unduly or pulverize under traffic. It is generally understood that on top of the concrete structure which is mixed in predetermined proportions, there is used a quick drying flush coat for the purpose of sealing the surface and protecting it pending the time the pavement becomes more solid from the compression which comes from traffic, and for the purpose of holding the gritty surface of stone chips. The careless use of flush coat composition has in some cases been a source of annoyance, although it has never affected the durability of the pavement. In laying the pavement in cold weather particularly, there is a tendency for the flush coat to chill and it requires promptness to prevent too large a quantity being left on the surface.

Again, if the flush coat is not covered over with hot stone chips it may chill and the chips in some cases do not unite with the flush coat. This is a cause of annoyance in the early spring when the flush coat becomes softened by the heat, but can easily be rectified by the rolling of additional stone chips into the surface. This class of defect occurred to a very small extent on the work done late last fall, but in several cases during the preceding year. Of course, the experience which comes from the actual construction of the pavement and a recognition of these possible defects make it possible to overcome them in the future, but it has been difficult to organize and educate a large number of men who are engaged in the industry in various sections of the country, to get that perfection of construction which is possible only through experience. We desire that the cities themselves should recognize these possible causes and through their engineers, officials and inspectors should aid by insisting on the work being done in a thorough manner. In the experience we have had up to date we have encountered no serious causes of error which cannot be easily overcome, and we have overcome the errors of previous years to such an extent that with the exception of one street, which involved an expense of some $2,200, where a large body of the mixture was burned through gross carelessness of the foreman and superintendent, which was not detected until the samples reached our laboratory, our entire expense of maintenance through the various cities of the United States where the pavement has been built has not this year exceeded $800 on all the work done prior to 1904, and this expense covers all of the many miles of work done by Warren Brothers' Company as direct contractors. It should be borne in mind that some of these pavements are now in their fourth year and that the aggregate quantity of Bitulithic pavement in use exceeds 160 miles of thirty-foot roadway.

Massachusetts has the reputation of having the best roadways of any section of the United States and I think she is entitled to this reputation. Boston has been the Company's headquarters, and naturally more attention has been given to the development in that section than anywhere else. The demand in the state of Massachusetts has been such that the pavement has been laid in sixteen cities and during the present year the amount of bitulithic laid in the state equals half the entire amount of asphalt paving in use in the state and we have laid this year more than seven times as much bitulithic as the entire amount of asphalt laid in the state during the year. The pavement is available, on account of its non-slipperiness of surface, for a large number of side hill streets where asphalt would be eminently unsuitable, and we believe it is generally recognized among the thoughtful road builders that in the construction of the bitulithic pavement we have overcome the principal causes of failure of asphalt which come from lack of inherent stability of the sand used in the asphalt structure and from the well-known effect of water in disintegrating natural asphalt.

The strongest point of the bituminous cement used in the bitulithic pavement is the fact that it is absolutely unaffected by water. This is due to the fact that the material is converted to a gas and in the gaseous state is purified by water, removing all matter soluble in water, and the refined material is not chemically acted upon by water either in light or darkness, while practically all of the natural asphalts are seriously affected by water. The free carbon which is converted from a bitumen while in the gaseous state takes the form of a flake with cells and when used in proper proportions in the bitumen adds very greatly to its life. The weakest point of a coal tar cement is that it is evaporated at low temperatures and if the carbon is used in insufficient quantities the life of the cement is greatly decreased, while if the carbon is used to excess it deadens the cement and destroys a considerable part of its binding qualities. It takes a great deal of care to manipulate the material and a knowledge drawn from experience of just what is required, but it is an entirely practical matter to get uniformity.

One of the strongest points of the pavement is the inherent stability imparted to the mixture by the proper grading of the stony elements, thus permitting the use of a softer cement with a lower melting point, and one which has less tendency to be deteriorated in process of mixing. This strong point becomes a source of weakness if the materials are not properly handled, for where we depend upon the inherent stability of the stone for a part of the strength and use a softer cement on this account, if the stone is not properly graded the cement may not give sufficient binding property to sustain the load under heavy traffic. This is easily provided against by care in the preparation of the mixture, but it would be absolutely folly to assume that the principal advantageous features of the bitulithic pavement could be secured without separating the material into a number of sizes and using them carefully and intelligently in predetermined proportions.

MR. FISHER: I should liketo ask one question. I had a message from the President and also one from Mr. Adam. I was requested by both of you to write something for this meeting. It happened that the request came to me at the culmination of several matters in our city which required my vigilant attention. I was therefore unable to prepare the paper. It occurred to me that possibly if I had known a few months ago instead of a few weeks, I might have been able to gather myself together and prepare such a paper. It takes some time to get statistics and prepare such a paper, for it should be in such a shape that it will be interesting to the Society. That is the way it affects me. Of course there are some people who can sit down and prepare a paper on short notice, but I am not one of them. I think parties should be notified so far in advance that there can be no question of their having time to prepare such papers.

PRESIDENT BALLARD: The chair is very glad the gentleman has made the statement he has. I am glad for more than one reason. It ought to be a well-known fact that every member of this Association has the right and the privilege of presenting a paper to this meeting at any time it is held. It is not necessary to receive an invitation from any official of this Society to write a paper to be presented here. That is the privilege, and in a great many instances, the duty of members of this Association, whether they are invited to furnish such papers or not. If a member has the ability to prepare a paper on any subject he thinks will be of interest to the Society, he is at liberty to do so at any time.

Prior to this meeting invitations were sent to many members asking them to prepare papers on various subjects. That does not by any means imply that only those who are asked specifically to present papers are privileged to send them. I believe each member of this Association, if he has the ability, should present something on some subject he thinks will benefit the Society. While I do not want to assume the prerogatives of my successor, I assume that every member of this Association is expected to present something if he has any views on any subject. He should do this and give the Society the benefit of his views on this particular subject. I went over the report and tried to fish out those who had been furnishing papers in the past, and also others whom I hoped would furnish papers for this or for future meetings. I hoped that all who could furnish such papers would do so. Now I hope you will all remember that the invitation is general and that you will not wait for specific invitations.

MR. ADAM: I think the old method should be followed. It is better than the one proposed. I wrote to Mr. Hatton asking him to contribute a paper on sewerage and sanitation. I was chairman of that committee. He promised he would prepare such a paper, and he has done so. I think it is a good idea for the chairmen of the committees to invite members to write papers on the subject each committee is formed to look after.

PRESIDENT BALLARD: Outside of those who are asked to present papers I think it is understood that every other member is desired to contribute papers to this meeting. Each member is requested to present a paper on some subject, and also to present it as early as he can to the President.

MR. HATTON: Even after you get down on your knees, figuratively speaking, it is difficult to get members to write papers.

MR. REIMER: If it is left to a committee of the whole and nobody is invited to prepare papers, I am afraid our next meeting will be without papers.

PRESIDENT BALLARD: I did not mean to be understood as saying that no members would be asked to contribute papers on specific subjects. That will be done, I suppose, as in the past. The idea I meant to convey was that members not invited are at liberty to present papers here on subjects they think will be of interest to the Society. As I said before, it is not only the privilege, but the duty of some of the members to present papers here, even if they have not been formally invited to do so by the officers of the Association.

I am exceedingly grateful to the members for their prompt attendance at the sessions of this convention. I am more than gratified to know that the old guard has stood by us faithfully at this time. It is a great gratification to me to know that at this last meeting of the convention nearly all the members who have been in attendance are here. I remember at former conventions when the last session was composed of about enough members to shake hands with and say good-bye. I am grateful to all the members for their prompt attendance and for their interest in the meetings.

I thank you all, gentlemen, from the bottom of my heart for the assistance you have given me during the past year. I hope you will accord to my successor in office the same attention and kindness you have shown me.

MR. REIMER: I move that the convention tender a vote of thanks to our retiring President and to the other officers for their untiring work for the interests of the Society during the year, and for their kindness and courtesy to the members.

The motion was seconded and carried by unanimous vote of the Society.

The convention was then adjourned sine die.

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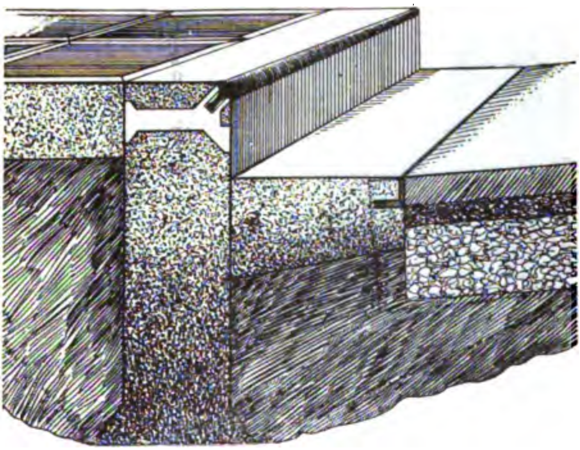

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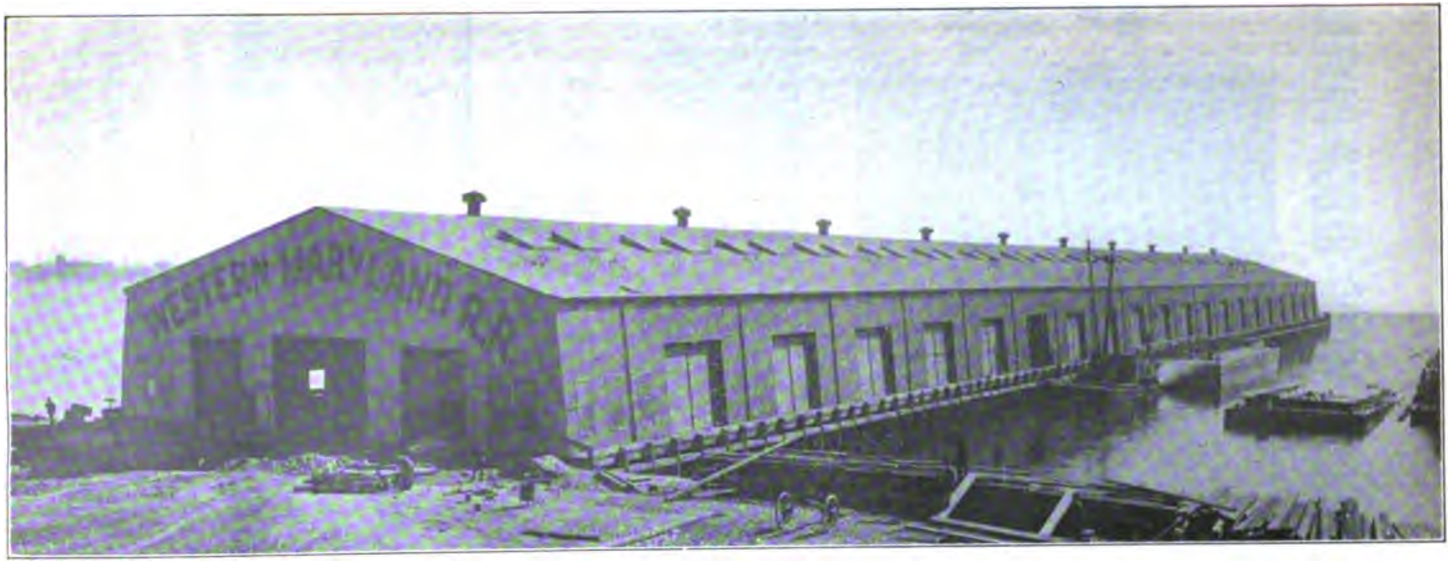

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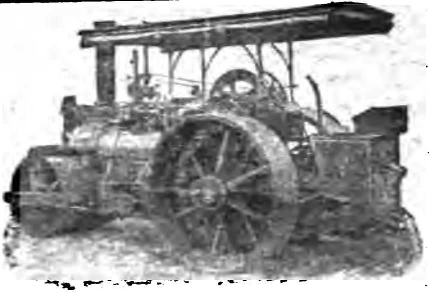

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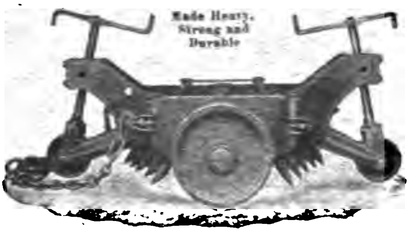
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THE NEXT MEETING WILL BE HELD AT BIRMINGHAM, ALA.

American Society of Municipal Improvements

OFFICERS

1905-1906

President	C. C. BROWN	Indianapolis, Ind.
First Vice-President	JOHN R. BARLOW	Montreal, Canada.
Second Vice-President	JAS. OWEN	Montclair, N. J.
Third Vice-President	JULIAN KENDRICK	Birmingham, Ala.
Secretary	GEO. W. TILLSON	Brooklyn, N. Y.
Treasurer	F. J. O'BRIEN	Oswego, N. Y.

FINANCE COMMITTEE

E. S. BARROW, Chairman	Hamilton, Ont.
A. F. EGGERS	Newark, N. J.
FRED GIDDINGS	Atchison, Kan.

EXECUTIVE COMMITTEE

The officers of this Society, together with the Past Presidents who have retained their continuous membership, constitute the Executive Committee. The Past Presidents are as follows:

PAST PRESIDENTS

M. J. MURPHY	St. Louis, Mo.
GEO. H. BENZENBERG	Milwaukee, Wis.
AUG. HERRMANN	Cincinnati, Ohio.
HARRISON VAN DUYNE	Newark, N. J.
NELSON P. LEWIS	Brooklyn, N. Y.
A. D. THOMPSON	Peoria, Ill.
ROBERT E. McMATH	St. Louis, Mo.
E. A. FISHER	Rochester, N. Y.
C. H. RUST	Toronto, Canada.
GEO. M. BALLARD	Newark, N. J.
A. PRESCOTT FOLWELL	Easton, Pa.

Standing Committees

Appointed by the President in accordance with Article IV, Section 4, of the Constitution of the Society.

1905-1906

STREET PAVING

JAMES OWEN, Chairman	Newark, N. J.
J. W. HOWARD	New York City.
E. A. HARPER	Kansas City, Mo.

ELECTRIC STREET LIGHTING

A. PARENT, Chairman	Montreal, Canada.
HENRY S. BAKER	Watertown, N. Y.
E. A. FISHER	Rochester, N. Y.

SEWERAGE AND SANITATION

J. N. HAZLEHURST, Chairman	Mobile, Ala.
W. H. LUSTER	Elizabeth, N. J.
WILLIAM H. FLOYD	St. Joseph, Mo.

WATER WORKS AND WATER SUPPLY

JULIAN GRIGGS, Chairman	Columbus, Ohio.
U. E. TAUBENHEIM	Archangel, Russia.
G. H. BENZENBERG	Milwaukee, Wis.

TAXATION AND ASSESSMENT

WILLIAM S. CRANDALL, Chairman	New York City.
CHARLES H. RUST	Toronto, Ont.
WILLIAM FORTUNE	Indianapolis, Ind.

CITY GOVERNMENT AND LEGISLATION

THOMAS NEVILLE, Chairman	Rochester, N. Y.
JULIAN KENDRICK	Birmingham, Ala.
N. I. KER	Ottawa, Canada.

DISPOSITION OF GARBAGE AND STREET CLEANING

T. C. HATTON, Chairman	Wilmington, Del.
HOWARD C. BAYLES	New York City.
JOHN R. BARLOW	Montreal, Can.

MUNICIPAL FRANCHISES

INSPECTOR OF GAS, Chairman	Cincinnati, O.
CHAS. H. RUST	Toronto, Ont.
E. S. BARROW	Hamilton, Ont.

REVIEW

A. PRESCOTT FOLWELL, Chairman	Easton, Pa.
THOMAS D. ALLIN	Pasadena, Cal.
J. M. HAMELL	Hull, Quebec.

Special Committees

Appointed by the President in accordance with resolutions adopted by the Society.

MUNICIPAL DATA AND STATISTICS

HUGO S. GROSSER, Chairman	Chicago, Ill.
H. N. RUTTAN	Winnipeg, Manitoba.
H. W. WILMOT	New York City.

PARK DEVELOPMENT AND MAINTENANCE

G. A. PARKER, Chairman (Supt. Keney Park)	Hartford, Conn.
JOHN McLAREN	San Francisco, Cal.
FRANK FOSTER	Chicago, Ill.

FIRE PROTECTION

ALCIDE CHAUSSE, Chairman	Montreal, Can.
PETER PROVOST	Ottawa, Can.
JOHN E. GRIFFITH	Brooklyn, N. Y.

EXHIBITS FOR NEXT MEETING

WM. S. CRANDALL	New York, N. Y.
R. K. DAVIS	Detroit, Mich.
E. J. SNOW	Brooklyn, N. Y.
T. H. BLAIR	Northboro, Mass.
GEO. W. TILLSON	Brooklyn, N. Y.
M. R. SHERRERD	Newark, N. J.
C. H. RUST	Toronto, Canada.

NOTICE

The Annual Reports for the former meetings are for sale by the Secretary at the following prices, including postage:

1895	$ .25	1901	$1.00
1897	1.25	1902	1.00
1898	1.25	1903	1.00
1899	1.00	1904	1.00
1900	1.00	1905	1.00

Annual dues per member	5.00

Address all communications to the Secretary,

GEO. W. TILLSON,
Municipal Building,
Brooklyn, N. Y.

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

CONSTITUTION OF THE SOCIETY

ARTICLE I—Name and Object.

Section 1. The objects of this Society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments, and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon Municipal Improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II—Membership.

Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer, or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work.

Any member who shall have ceased to have charge or supervision of any public or municipal department or work may retain his membership, unless he shall have come under the restrictive requirements of associate membership, when he shall retain membership as an associate only.

Sec. 2. Every application for membership shall be in writing, stating the name, location and department, if any; and, if of an individual, shall also state age, residence and position of the applicant, if any.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III—Fees and Dues.

Section 1. Each corporate member shall pay five dollars per annum, and each associate member shall pay ten dollars per annum. All dues to be payable in advance, on or before the date of the annual meeting.

ARTICLE IV—Officers.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of the same state, and who with the Past Presidents who have retained their continuous membership shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following standing committees:

1. Street-Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any liabilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI—Duties.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII—MEETINGS.

Section 1. The annual meeting of the Society shall be held on the second Wednesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII—ORDER OF BUSINESS.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Report of special committees.
9. Reading and discussion of papers.
10. Election of officers.
11. Selection next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX—AMENDMENTS.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vote of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the 1st day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain, from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

LIST OF MEMBERS

CORPORATE MEMBERS

Ackerman, J. Walter, City Engineer, Auburn, N. J.
Allen, C. R., Jr., City Engineer, Barre, Vt.
Allin, Thos. D., City Engineer, Pasadena, Cal.
Alvord, John W., Consulting Engineer, 127 Hartford Bldg., Chicago, Ill
Anderson, L. W., City Engineer, Grand Rapids, Mich.
Andrews, Horace, 125 Lancaster St., Albany, N. Y.
Arthur, William H., Superintendent of Public Works, Stamford, Conn.

Baker, Henry E., City Engineer, Watertown, N. Y.
Ballard, Geo. M., Chairman Water Committee, Newark, N. J.
Barlow, John R., City Engineer, Montreal, Canada.
Barr, J. Carroll, Economy, Pa.
Barrow, E. S., City Engineer, Hamilton, Ont.
Bauman C. V., Street Committee, Newark, N. J.
Bayles, Howard G., Consulting Engineer, 37 W. 34th St., New York City.
Benzenberg, Geo. H., Consulting Engineer, 436 Jefferson St., Milwaukee, Wis.
Berry, George, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Blair, Bryce R., City Engineer, Carbondale, Pa.
Boley, C. U., Engineer, Sheboygan, Wis.
Bragg, Harry, Editor Canadian Municipal Journal, Montreal, Canada.
Breen, J. E., Chief Engineer, Board of Public Service, Cincinnati, O.
Briggs, B. E., City Engineer, Erie, Pa.
Brown, Charles C,, Editor Municipal Engineering, Indianapolis, Ind.
Brown, C. W., City Clerk, Winnipeg, Man.

Cappelen, F. W., 702 Oneida Block, Minneapolis, Minn.
Carpenter, George A., City Engineer, Pawtucket, R. I.
Case, E. W., City Engineer, Colorado Springs, Colo.
Chairman of Municipal Council, St. Johns, Newfoundland.
Chausse, Alcide, Building Inspector, Montreal, Can.
Christy, L. V., Secretary Street and Sewer Dept., Wilmington, Del.
Clark, Alfred, Commissioner of Highways, Concord, N. H.
Crandall, Wm. S., Room 420, 253 Broadway, New York City.

Dalrymple, F. W., City Engineer, Bayonne, N. J.
Devereux, Harry H., Mayor, Springfield, Ill.

Easby, Wm. Jr., Asst. Professor of Civil Engineering, College Hall, University of Pennsylvania, Phildelphia, Pa.
Eggers, Augustus F., Board of Works, Newark, N. J.

Fendall, Benj. T., City Engineer, Baltimore, Md.
Fisher, E. A., City Engineer, Rochester, N. Y.
Floyd, William H., Jr., City Engineer, St. Joseph, Mo.
Folwell, A. Prescott, Consulting Engineer, Easton, Pa.
Fort, E. J., Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Fortune, Wm., Publisher Municipal Engineering, Indianapolis, Ind.
Freiberg, M. J., Waterworks Commission, 216 E. Front St., Cincinnati, O.
Freshney, S. A., Secretary and General Manager, Board of Public Works, Grand Rapids, Mich.

Giddings, Fred, City Engineer, Atchison, Kan.
Glore, W. H., Superintendent Waterworks, Covington, Ky.
Goodell John M., Editor Engineering Record, 114 Liberty St., New York.
Greathead, Wm. E., Clerk Board of Public Works, Newark, N. J.
Griffith, John E., Assistant Engineer, Dep't of Water Supply, Borough of Brooklyn, N. Y.
Griggs, Julian, Engineer, Dept. of Public Works, Columbus, O.
Grosser, Hugh S., City Statistician, 207 City Hall, Chicago, Ill.

Hamell, J. M., City Engineer, Hull, Que.
Hamilton, Frank H., City Engineer, Springfield, Ill.
Harper, E. A., City Engineer, Kansas City, Mo.
Hatton, T. Chalkley, City Engineer Street and Sewer Dept., Wilmington, Del.
Hazelhurst, J. N., Engineer Board of Public Works, Mobile, Ala.
Herrman, August, President Waterworks Commissioners, Cincinnati, O.
Holloway, C. M., Waterworks Commissioner, Cincinnati, O.
Howard, J. W., Consulting Engineer, No. 1 Broadway, New York, N. Y.
Howe, W. B., City Engineer, Concord, N. H.

Johnson, Edward J., City Engineer, Nashua, N. H.
Johnston, A. L., Sewer Department, Wilmington, Del.
Jones, John, Superintendent of Streets, Toronto, Ont.
Judson, William Pierson, Broadalpin, Fulton Co., N. Y.

Kendrick, Julian, City Engineer, Birmingham, Ala.
Ker, N. I., City Engineer, Ottawa, Can.
Kern, Fred J., Mayor, Belleville, Ill.
Kummer, F. J., General Manager U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Leisen, Theo. A., Wilmington, Del.
Lewis, N. P., Chief Engineer Board of Estimate and Apportionment, New York City.
Luster, W. H., City Surveyor, Elizabeth, N. J.

McCartin, J. M., Street Commissioner, Birmingham, Ala.
McClintock, John N., Consulting Engineer, 45 Milk St., Boston, Mass.
McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.
McMillan, Chas., City Clerk, Calgary, Canada.
Magley, Wm., Board of Public Service, Cincinnati, O.
Markbreit, L., Waterworks Commission, Cincinnati, O.
Mead, D. W., 605 First Natoonal Bank Bldg., Chicago, Ill.
Melvin, T. H., Sewer Dept., Wilmington, Del.
Minshall, Frederick, Consulting Engineer, Abbeville, S. C.

Nelson, John A., City Engineer, Mitchell, S. D.
Neville, Thos., Deputy Commissioner of Public Works, Rochester, N. Y.

O'Brien, F. J., Street Commissioner, Oswego, N. Y.
Owen, Jas., Consulting Engineer, 196 Market St., Newark, N. J.

Parent, Arthur, Supt. City Lighting Dept., Montreal, Canada.
Parker, G. A., Superintendent Keney Park, Hartford, Conn.
Phillips, Geo., Board of Public Works, Newark, N. J.
Phinney, F. J., Superintendent Water Works, Rockford, Ill.
Pollock, Clarence D., Assistant Engineer Bureau of Highways, Brooklyn, N. Y.
Potter, W. G., City Engineer, Greensboro, N. C.
Provost, A. J., Jr., Engineer to Borough President, Brooklyn, N. Y.
Provost, Peter, Chief Fire Dept., Ottawa, Canada.

Rankine, E. S., Engineer Sewer Department, Newark, N. J.
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.
Reichardt, Walter F., Assistant City Engineer, Little Rock, Ark.
Reimer, W. H. V., City Engineer, East Orange, N. J.
Reiter, George W., City Engineer, Salt Lake City, Utah.
Richey, A. D., City Engineer, Elwood, Ind.
Rommel, Geo., Jr., Engineer Street and Sewer Dept., Wilmington, Del.
Rust, Chas. H., City Engineer, Toronto, Ont.
Ruttan, H. N., City Engineer, Winnipeg, Manitoba.

Sanderson, H., Alderman, Winnipeg, Man.
Schmidt, Jacob, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Sheridan, John C., Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.
Sherrerd, M. R., Superintendent Waterworks, Newark, N. J.
Shipman, Charles M., Gen'l Supt. of Works, Newark, N. J.
Skaife, Lewis, 20 St. James St., Montreal, Canada.
Strachan, Joseph, Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.

Steece, Emmet, City Engineer, Burlington, Ia.
Stewart, Wm. J., First Assistant City Engineer, Rochester, N. Y.
Stobaeus, J. B., Member Board of Trade, Newark, N. J.

Talbot, A. N., Professor of Civil Engineering, University of Illinois, Urbana, Ill.
Taubenheim, Ulrich E., Manager City Waterworks, Archangel, Russia.
Thompson, A. D., 304 Masonic Temple, Peoria, Ill.
Thompson, S. C., Prin. Asst. Engineer Bureau of Highways, Borough of Bronx, New York.
Tillson, Geo. W., Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Todd, Fred. G., Landscape, Architect, Montreal, Canada.

Vinson, J. S., Board of Public Works, Newark, N. J.
Vrooman, Morrell, City Engineer, Gloversville, N. Y.

Weil, Samuel, Jr., Board of Public Service, Cincinnati, O.
Wheeler, Holland, City Engineer, Lawrence, Kan.
Whipple, George C., Consulting Engineer and Sanitary Expert, 220 Broadway, N. Y.
Wilmot; H. W., Expert Accountant, 54 William St., New York City.
Woods, F. H., Chairman Commission on Works, Toronto, Ont.

ASSOCIATE MEMBERS

Adler, Arthur A., 804 Chamber of Commerce, Chicago, Ill.
Anders, W. R., 1813 Chemical Bldg., St. Louis, Mo.

Bangham, Richard, Ontario Asphalt Block Co., Windsor, Ont.
Beck, H. N., Mgr. Canada Fire Hose Co., 14 St. Sacrament St., Montreal, Canada.
Berger, W. A., Manfr. Surveying Instruments, 37 William St., Boston, Mass.
Blair, F. N., President Blair Light Co., Northboro, Mass.
Buff, Lewis F., Asst. Treas. Buff & Buff Mfg. Co., Jamaica Plains, Boston, Mass.
Buffalo Steam Roller Co., Buffalo, N. Y.

Cameron, Hugh, Agent Waterous Engine Co., 72 Queen St., W. Toronto, Canada.
Coburn, H. P., General Manager, Sawyer & Massey Co., Hamilton, Ont.
Cochrane, D. J., Sicily Asphaltum Paving Co., Montreal, Canada.
Colas, Jules, Mfr. of steel gullies, 6 St. Denis St., Montreal Canada.

Decarie, F. L., Chief Engineer, Decarie Mfg. Co., Minneapolis, Minn.
Dill, Charles W., Manager Constructing & Paving Co., Toronto, Ont.
Drummond, T. J., President Montreal Pipe Foundry Company, Vice-President Montreal Water & Power Co., Montreal, Canada.

Ellis, Geo. V., President Ellis Company, 216 W. 23rd St., New York City, N. Y.

Folger, M., President, Thompson Meter Co., Brooklyn, N. Y.
Folkes, E. C. E., Manager Wilkinson Plough Co., Toronto, Can.
Fuller, H. J., President, Canadian Fairbanks Co., Montreal, Can.

Godson, A. W., President, Godson Contracting Co., Toronto, Can.
Gould, Norman J., Seneca Falls, N. Y.
Gravel, Ludger, 26 Place Jacques Cartier, Montreal, Can.

Hill, A. J., American Asphaltum & Rubber Co., Chicago, Ill.

Ingram, G. M., 81 N. Cherry Street, Nashville, Tenn.
Irwin, A. B., Sec. and Treas. Pacific Coast Pipe Company, 1551 Granville Street, Vancouver, B. C.

Koelsch, P. A., Dealer in Engineers' Supplies, 138 Fulton Street, New York City, N. Y.

McEvoy, John G., Secretary and General Manager McEvoy Vit. Brick Co., 1345 Arch Street, Philadelphia, Pa.
Martin Harry K., Fire Appliances; Street Railway Chambers, Montreal, Can.
Morrison, James, President James Morrison Brass Mfg. Co., Toronto, Ont.
Morrison, T. A., 204 St. James St., Montreal, Can.
Mussen, W. H. C., 299 St. James Street, Montreal, Can.

Pittsburg Filter Company, Pittsburg, Pa.
Pough, F. H., Sewer Cement Manufacturer, 28 Burling Slip, New York City.

Rinkert, H. T., Sec'y and Treas. Metropolitan Paving Brick Co., Canton, Ohio.
Root, John M., General Manager Decarie Manfg. Co., Minneapolis, Minn.
Russel, Jas. C., Sec'y and Treas. John McDougal Caledonian Iron Works Co., Montreal, Can.

Sayer Electric Co., 14 Beaver Hall Hill, Montreal, Can.
Scholl, Julian, 126 Liberty Street, New York, N. Y.
Sessions, Wm. E., Prop. Sessions Foundry Co., Bristol, Conn.
Sise, Paul, Manager Northern Electric Co., Montreal, Can.
Strain, Jas. H., Road Rollers and Road Machinery, 254 East Twenty-first St., Brooklyn, N. Y.

Trudel, Tancrede, 107 Bleury Street, Montreal, Can.

Warren, Geo. C., 93 Federal Street, Boston, Mass.
Wertz, J. L., Vice President Neptune Meter Co., 120 Liberty Street, New York City, N. Y.
Whitaker, W. H., Sec'y Gould, Shapley & Muir Co., Brantford, Ont.
Wood, R. D. & Company, Waterworks Supplies, 400 Chestnut St., Philadelphia, Pa.
Wunder, F. A., Iroquois Iron Works, Buffalo, N. Y.
Wyllie, H. D., General Manager Cameron Septic Tank Co., 812 Monadnock Block, Chicago, Ill.

NEW YORK, October 17th., 1905.

MR. GEO. W. TILLSON, Sec'y American Society of Municipal Improvements,
Room 12, Municipal Bldg., Brooklyn, N. Y.

DEAR SIR: It is the hope of the Board of Directors of the American Society of Civil Engineers that its cordial relations with other associations of engineers be maintained and if possible strengthened.

I am therefore directed to say that the Society will always be glad to receive visits from your members; that its Reading Room and Library are open to them; and that their presence at any of its professional meetings (which are held at 8:30 P. M. on the first and third Wednesdays of each month, with the exception of July and August) will be most heartily welcome.

Trusting that you will inform the membership of your Society that this is the case, and that we shall have the pleasure of receiving such of them as may find it convenient when on New York, I am

Yours faithfully,
CHAS. WARREN HUNT,
Secretary.

PROCEEDINGS

OF THE

TWELFTH ANNUAL CONVENTION

OF THE

American Society of Municipal Improvements

HELD AT

MONTREAL, CAN., SEPT. 5, 6 AND 7, 1905

The opening session of the Convention was called to order at 2:30 P. M., on Tuesday, September 5th, 1905, at the Crystal Rink, Montreal, the President of the Society, Mr. A. Prescott Folwell, being in the chair.

Vice President, Mr. John R. Barlow, opened the proceedings by introducing His Worship, Mr. H. Laporte, Mayor of the City of Montreal. Mr. Barlow spoke as follows:

Mr. President and Members of the American Society of Municipal Improvements: We have with us this afternoon His Worship Mr. Laporte, Mayor of this City of Montreal, who has kindly consented, on behalf of the citizens, to extend to us the welcome of the city. I take great pleasure in introducing Mr. Laporte to you.

MR. LAPORTE: Mr. President, and Ladies and Gentlemen of the American Society of Municipal Improvements: It was a pleasant intelligence for me when I learned that your Society proposed holding its convention in our City of Montreal. The reputation of your Association had preceded you here, and I remember at least two of your members, our city surveyor, and our building inspector telling us months ago of the great work which you are undertaking, and which is bearing such good results.

It is indeed a pleasant task for me, as mayor of this city, and on behalf of the citizens generally, to extend to you all a most cordial welcome, and to assure you that we consider ourselves honored by your presence.

I have been told that the object of your Association is to disseminate information and knowledge concerning municipal matters generally, and to promote the best methods in connection with the management of all municipal departments. Your labors are such that they are of direct interest to municipalities throughout the entire American Continent, inasmuch as you deal with conditions generally affecting every one of them.

Montreal is gaining ground rapidly as a convention city, and we are pleased that this is so, and that it is becoming quite a usual thing for American and Canadian societies to assemble here, because we feel that nothing tends more to promote that "entente cordiale" between two countries than this same visiting and friendly intercommunication of the people.

Therefore, I pray you, ladies and gentlemen, to consider yourselves quite at home in our city, the Commercial Metropolis of Canada, and I hope that your convention will be a great success, and will result in benefits to yourselves as a body, and to the community at large. I also trust that after your meeting here you will return to your homes bringing with you pleasant and kind memories of your visit to Montreal.

Mr. Barlow: It is my pleasant duty to present to you Mr. C. H. Catelli, representing the Chambre de Commerce of the City of Montreal.

Mr. Catelli: Mr. Chairman and Gentlemen: It is with marked pleasure that I greet the coming of your Association to the metropolis of Canada.

In tendering you this welcome I simply voice the sentiments of the "Chambre de Commerce," which I have the honor to represent at this function, through the inability of our President to be here.

Your Association is performing a task of the greatest importance to urban populations: the health and comforts of city life. Its work is of the most momentous importance to mankind at large.

The program of your meetings, which is very comprehensive, covers almost the whole ground. I read, for instance, "Statistics" at the top of the list, which check the conditions of mortality and births, and thereby helps to control the sanitary conditions of the vulnerable point of a country—the cities and towns.

The "Municipal Franchises"—a question up to date in different cities, but it seems of the greatest economic complexity.

"Taxation and Assessment, City Government and Legislation." Some of our city fathers will, no doubt, take up this question.

"Park Development and Maintenance." "The parks are the lungs of a city."

"Street Paving." A subject of the greatest importance to a commercial and industrial city.

"Disposition of Garbage and Street Sweepings"—Two great causes of contamination of the air, and the origin of the spread of diseases.

"Street Lighting"—The most efficient auxiliary of the police, and a safeguard against crime.

"Waterworks and Water Supply"—Pure water has been stated to be the greatest sanitary agent of nature. We need pure and cheap water in unlimited quantities.

"Sewage and Sanitation"—The safe disposal of the sewerage of a large city is of the greatest importance to a vast expanse of country. The danger of the pollution of rivers and ponds being ever present, with its train of attendant diseases, etc., makes this probably one of the most important of all the subjects that have to be dealt with.

This dry enumeration of subjects for discussion suffices to show the vastness of the domain and the great importance of your meetings in dealing with the conditions of life and sanitation in cities and industrial centers.

The great task to which you have set your hands is not of a class which admits of an easy, quick and general solution, but your Association contains all the elements that help to secure the desired success. Of this I have not the least doubt.

I thank you, ladies and gentlemen, for your kind attention, and I hope that one and all will enjoy the stay in this city of ours, and that the meeting will be one of the most successful that you have ever held.

MR. BARLOW: I now present to you Mr. Charles Chaput, Vice President of the Canadian Business Men's League. Mr. Miles, the President of that organization, has found it impossible to be present, and has delegated Mr. Chaput in his stead. I am very pleased to introduce Mr. Chaput.

MR. CHAPUT: Mr. President, Ladies and Gentlemen: After what has been said so eloquently by the two previous speakers I might dispense with addressing you entirely, but, as representing the Business Men's League, I cannot allow this opportunity to pass without adding my welcome to what has already been said.

In the name of the Business Men's League, I wish you all a hearty welcome to this grand old city of ours, and I hope that your stay with us will be pleasant and profitable.

The Montreal Business Men's League has, since its inception, taken a deep interest in all conventions that come to our city, and I think I may say without fear of contradiction that the honor and pleasure of having you here to-day is due, to a very large extent to the energy of one of our members, Mr. Alcide Chausse, your Finance Committee Chairman. (Applause.)

You are here, gentlemen, on business, and I might say very important business. The prosperity of a city, and its growth depend largely upon its municipal administration, and one of the objects of your Association is to improve that administration, and I do not doubt, Mr. Chairman, that a great deal of good will be derived by the City of Montreal from your convention here to-day.

I hope that you will leave our city feeling that you have been able to combine business with pleasure.

Mr. Barlow: I have been informed that the Honorable Mr. Gouin, Prime Minister of the Province of Quebec, and the President of the Board of Trade have been unable to make arrangements to be present with us. Those gentlemen regret exceedingly their inability to be here, and I am sure that we would have very much appreciated the opportunity of listening to them if it had been possible for them to come.

I will call upon our President, Mr. A. Prescott Folwell, to respond to the kind words of welcome which have been extended to us.

President Folwell: Your Worship, and gentlemen representing the Citizens' Associations who have extended us so cordial a welcome: On behalf of the American Society of Municipal Improvements I desire to thank you first of all for your kind welcome to your city, and for your appreciation of the aims and objects of our Society, and also for the preparations which you have made for our entertainment, which no doubt will prove to be of the most interesting character, being different to anything we have ever before experienced, as an organization.

In fact, so thorough has been your desire to please us that I notice that you have even had some of your streets washed, and given the city a most careful cleaning.

This Society, gentlemen, is named the American Society of Municipal Improvements. I notice that on this side of the line, as well as on our side, the word "American" is, to a large extent, confined to the United States, but in the naming of our Society, and certainly in the carrying on and development of it, the word "American" has been used in its broader and it seems to many of us, its truer sense—as comprising the whole American Continent.

We are very glad that we can count among our membership a considerable percentage of the citizens of Canada, and we find among them some of our worthiest members. We have selected one of your citizens, Mr. Chausse, year after year for the Chairmanship of our Finance

Committee, and a year or two ago, as was facetiously remarked by a former President, or by a member, we were proud to be under a Canadian President, although we were citizens of the United States.

In this Society we have done all in our power to cement the bonds of friendship, and stretch hands—not across the sea—but across the international boundary to our colleagues, the citizens of Canada, and I think when we United States Americans are entertained by the City of Montreal, as we were six years ago by the City of Toronto, and become acquainted with your citizens and the beauties of your city, and receive such excellent and cordial treatment from your citizens as we have been receiving, we can fairly well consider ourselves as a branch of the Peace Congress. I believe, in fact, that we deserve to be recognized as a Chapter of the International Peace Congress, for there is nothing better than acquaintanceship to cement one nation to another, and to prevent recourse to arms.

If in the course of a few more years it should be our good fortune to come to Canada again for one of our conventions, and we are treated as we have been in the past, surely no Congress could make us take up arms against one another.

The members of our Association and the visitors have looked over the splendid program of entertainment that has been prepared for us with very much interest and we look forward with anticipation to its being carried out, and on behalf not only of the Association, but on behalf of the ladies and the other visitors, I wish again to thank you, and through you the citizens of Montreal for your most generous and cordial treatment.

I think we may consider this as the formal opening of the Twelfth Annual Convention of this Association in the City of Montreal.

The first business session of the Society was called to order at 3:10 P. M., on Tuesday, September 5th, the President, Mr. A. Prescott Folwell, being in the chair.

After the meeting had come to order the President said:

In the past it has been customary to dispense with the roll call, inasmuch as the roll of members consists, or should consist of the register. If there are any members present who have not signed the roll it is to be hoped that they will do so as soon as possible. We have to insist on this at every meeting. It is very important, as it is the only record we have of those in attendance upon the meeting.

The next order of business is the reading of the minutes of the last meeting. Since they have been published, and each member furnished with a copy, it does not seem necessary to read them here, and so, if there is no objection, we will dispense with the reading of the minutes of the last meeting.

There being no objection to not reading the minutes we will pass on to the next order of business, which is the consideration of applications for membership.

THE SECRETARY: I have applications for membership from the following gentlemen:

CORPORATE MEMBERS.

John C. Sheridan, Assistant Engineer, Bureau of Highways, Borough of Brooklyn.
Jos. Strachan, Assistant Engineer, Bureau of Highways, Borough of Brooklyn.
Geo. Berry, Assistant Engineer, Bureau of Highways, Borough of Brooklyn.
E. J. Fort, Assistant Engineer, Bureau of Highways, Borough of Brooklyn.
Geo. C. Whipple, Consulting Engineer and Sanitary Expert, 220 Broadway, New York.
W. H. Luster, Jr., City Surveyor, Elizabeth, N. J.
F. W. Dalrymple, City Engineer, Bayonne, N. J.
John E. Griffith, Asst. Engineer Department of Water Supply, Brooklyn.
U. E. Taubenheim, Manager City Waterworks, Archangel, Russia.
Arthur Parent, Supt. City Lighting Department, Montreal.
E. A. Harper, City Engineer, Kansas City, Mo.
E. W. Case, City Engineer, Colorado Springs.
Henry E. Baker, City Engineer, Watertown, N. Y.
Wm. H. Floyd, Jr., City Engineer, St. Joseph, Mo.
Geo. W. Riter, City Engineer, Salt Lake City.
Bryce R. Blair, City Engineer, Carbondale, Pa.
Thos. D. Allin, City Engineer, Pasadena, Cal.
Frederick Minshall, Consulting Engineer, Abbeville, S. C.
J. E. Breen, Chief Engineer Board of Public Service, Cincinnati, Ohio.
John H. Nelson, City Engineer, Mitchell, S. D.
Lewis Skaife, 20 St. James Street, Montreal.
Holland Wheeler, City Engineer, Lawrenece, Kas.
Fred G. Todd, Landscape Architect, Montreal.
Howard G. Bayles, Consulting Engineer, 37 W. Thirty-fourth St., New York City.
Jacob Schmidt, Asst. Engineer, Bureau of Highways, Brooklyn, N. Y.
Morrell Vrooman, City Engineer, Gloversville, N. Y.
J. Walter Ackerman, City Engineer, Auburn, N. J.

C. R. Allen, Jr., City Engineer, Barre, Vt.
W. G. Potter, City Engineer, Greensboro, N. C.
Wm. H. Arthur, Supt. of Public Works, Stamford, Conn.
Hugh S. Grosser, City Statistician, 207 City Hall, Chicago, Ill.
J. M. Hamell, City Engineer, Hull, Que.
Geo. A. Carpenter, City Engineer, Pawtucket, R. I.
Peter Prevost, Chief Fire Dept., Ottawa, Ont.
A. L. Johnston, Sewer Dept., Wilmington, Del.
T. H. Melvin, Sewer Dept., Wilmington, Del.
S. A. Freshney, Sec. and Gen. Manager Board of Public Works, Grand Rapids, Mich.
Harry Bragg, Editor *Canadian Municipal Journal,* Montreal.
Chas. M. Shipman, Gen. Supt. of Works, Newark, N. J.
H. Sanderson, Alderman, Winnipeg, Manitoba.
C. W. Brown, City Clerk, Winnipeg, Manitoba.

ASSOCIATE MEMBERS.

Norman J. Gould, Seneca Falls, N. Y.
T. A. Morrison, 204 St. James St., Montreal.
Geo. C. Warren, 93 Federal St., Boston.
H. D. Wyllie, General Manager Cameron Septic Tank Co., 812 Monadnock Block, Chicago, Ill.
G. M. Ingram, 81 N. Cherry St., Nashville.
Julian Scholl, 126 Liberty St., New York.
Ludger Gravel, 26 Place Jacques Cartier, Montreal, Can.
H. J. Fuller, President Canadian Fairbanks Co., Montreal.
Richard Bangham, Ontario Asphalt Block Co., Windsor, Ont.
W. H. C. Mussen, 299 St. James St., Montreal.
A. B. Irwin, Sec'y and Treas. Pacific Coast Pipe Co., 1551 Granville St., Vancouver, B. C.
Buffalo Steam Roller Co., Buffalo, N. Y.
T. J. Drummond, Pres. Montreal Pipe Foundry Co.; V. P. Montreal Water and Power Co., Montreal.
John M. Root, Gen'l Manager Decaire Manfg. Co., Minneapolis, Minn.
F. L. Decarie, Chief Engineer Decarie Manfg. Co., Minneapolis, Minn.
Tancrede Trudel, 107 Bleury St., Montreal.
H. P. Coburn, Gen. Manager Sawyer & Massey Co., Hamilton, Ont.
Chas. W. Dill, Manager Constructing and Paving Co., Toronto.
Jules Colas, Mnfr. of Steel Gullies, 6 St. Denis Street, Montreal.
M. Folger, Pres. Thomson Meter Co., Brooklyn.
F. H. Pough, Sewer Cement Manufacturer, 28 Burling Slip, New York.
John C. McEvoy, Sec. and Gen. Mgr. McEvoy Vit. Brick Co., 1345 Arch Street, Philadelphia.
R. D. Wood & Co., Waterworks Supplies, 400 Chestnut St., Philadelphia.
J. L. Wertz, V. P. Neptune Meter Co., 120 Liberty Street, New York.
W. A. Berger, Manfr. Surveying Instruments, 37 Williams St., Boston.

P. A. Koelsch, Dealer in Engineers' Supplies, 138 Fulton St., New York.
Geo. V. Ellis, Pres. Ellis Company, 216 W. Twenty-third St., New York.
F. N. Blair, Pres. Blair Light Co., Northboro, Mass.
A. W. Godson, Pres. Godson Contracting Co., Toronto, Ont.
Pittsburg Filter Co., Pittsburg, Pa.
Sayer Electric Co., 14 Beaver Hall Hill, Montreal, Can.
E. G. E. Folkes, Mgr. Wilkinson Plough Co., Toronto.
Hugh Cameron, Agent Waterous Engine Co., 72 Queen Street, W. Toronto.
Jas. C. Russel, Sec. and Treas. John McDougal Caledonian Iron Works Co., Montreal.
H. N. Beck, Mgr. Canada Fire Hose Co., 14 St. Sacrament St., Montreal.
W. H. Whitaker, Sec. Gould, Shapley and Muir Co., Brantford, Ont.
James Morrison, Pres. James Morrison Brass Mfg. Co., Toronto.
H. T. Rinkert, Sec. and Treas. Metropolitan Paving Brick Co., Canton, O.
Wm. E. Sessions, Proprietor Sessions Foundry Co., Bristol, Conn.
Lewis F. Buff, Asst. Treas. Buff and Buff Mfg. Co., Jamaica Plains, Boston.
Paul Sise, Mgr. Northern Electric Co., Montreal.
Harry K. Martin, Fire Appliances, Street Railway Chambers, Montreal.
W. R. Anders, 1813 Chemical Bldg., St. Louis.
F. A. Wunder, Iroquois Iron Works, Buffalo.
A. J. Hill, American Asphaltum and Rubber Co., Chicago.
D. J. Cochrane, Sicily Asphaltum Paving Co., Montreal.

MR. SHERRERD: I would move that the Secretary be requested to cast a single ballot electing those gentlemen to membership.

Which, being duly seconded, was carried, and the Secretary cast the ballot as requested, and the applicants were declared members of the Society.

THE PRESIDENT: The next item of business is the President's address. This year the President has only written a comparatively brief address, knowing that we would have a good many papers and a great deal of other business to deal with.

If you will bear with me for a few moments I will try to get through my remarks as quickly as possible, and we will pass on to things more interesting.

PRESIDENT'S ANNUAL ADDRESS.

Eleven years ago to-day, less two weeks, this Society was organized in Buffalo, with sixty members. During the next three years this number greatly increased, and the Society became recognized as an influential and important body of workers for municipal progress. Its good work has continued, and the Society has maintained a high reputation for earnest endeavor, which it is to be hoped it will continue to deserve. Of the size of its membership, however, the record is less favorable. While the good accomplished by a society is by no means to be gauged by its size, yet its influence can not be as well maintained or as widespread, nor will its standing be as generally recognized if its numbers diminish too seriously. During the second three-year period of this Society's history the number of members decreased practically one half; and during the four succeeding years it remained practically stationary, making a net gain of but eleven during that time. To many of our members this failure to increase in size seemed ominous—a halting in uncertainty between a lapse into oblivion on the one hand and on the other a great increase in size and influence. With the hope of directing it toward the latter, they have made a special effort this year to increase the membership, and have so well succeeded that we have in one year more than recovered all our lost ground, and our membership is now larger than ever before. Thus encouraged, it is hoped that not only those who have already done such good service for the Society, but all the members will continue the work, and that our numbers may be increased by at least fifty per cent annually until every municipality of the country is represented.

If there is a place for this Society which no other fills, if there is a work for this Society to do which is not within the province of any other, then it is our duty to make our utmost endeavor to extend its power for good into every city of the land. But if there is no good and logical reason for its existence, if the work we are attempting to perform is of no value or is a mere duplication of that which is being better done by others, then our efforts are being wasted, and the sooner we appreciate this and disband, and direct them into other channels the better for us as individuals and for the cause of municipal betterment. If there *is* a certain area in the field of municipal advancement which is peculariarly our own—and I firmly believe there is—then our best work will result from a study of its nature and confining our energies within its boundaries.

As stated by our Constitution, the object of this Society is "to disseminate information and experience upon, and to promote the best methods to be employed in, the management of municipal departments and in the construction of municipal works."

The National Municipal League is largely composed of citizens as such only who consider "political, administrative and educational phases of the municipal problem." In the League of American Municipalities are gathered the mayors and other officials of our cities to study "all questions pertaining to municipal administration." The purpose of the American Civic Association is "the cultivation of higher ideals of civic life and beauty in America."

The first two consider chiefly municipal administration as a whole, and the methods of co-ordinating various municipal departments, but in only a minor degree the details of the management of individual departments; while this last would seem to be explicitly stated as one of the objects of this Society, and one worthy of our earnest consideration.

At first thought it might seem that the field of engineering was already more than covered by existing societies. An examination of the work done by these, however, will show that this is not the case. The American Society of Civil Engineers and its Canadian sister, since they cover the entire field of engineering, pay very little attention to municipal engineering, as an inspection of their proceedings will show. The various state and sectional societies do somewhat more along this line, but the amount is still relatively small and there is a tendency to continuance in local ruts. The municipal engineers of Greater New York have recently formed a society which has a most promising future, but its membership is limited to that corporation. There is a place, then, for a society which will do for all the other and smaller cities of the country what this last society does for New York; and many of the members even of that society have joined with us for mutual benefit along the line of municipal engineering. One branch of this, however—water supply—is well served by several societies, notably the American Water Works Association and the New England Water Works Association. But street paving, cleaning and general maintenance, refuse collection and disposal, sewerage and sanitation (except as the latter is treated from the physician's point of view by the American Public Health Association) and many other avenues for municipal improvement await the assistance of this Society in their development.

The above considerations might give the impression that there is left for us only details of administration and construction, but such is far from being the case. We may treat as experts of the broad subject of the relative values of various utilities to a modern city, which are essential and which non-essential to its most profitable growth. We will be doing a better work in persuading a city to adopt proper sanitary garbage disposal than in designing the details of its plant. To demonstrate and convince of the sanitary superiority and greater economy of a sewerage system over cesspools is as important as to build the system.

But perhaps most important of all is it that we should offer opportunities to those civic officials who find them in no other society for that personal contact between those having similar aims and life purposes which gives them encouragement and inspirations of renewed vitality in their too often unappreciated and discouraged efforts for the betterment of their respective cities.

To a certain extent it is a weakness, but to a much greater extent should it be a strength, that our membership is not composed of one class only of officials, but that mayor, alderman, engineer and street and other superintendents all meet here to exchange ideas and learn each other's points of view, and our discussions should be and to a large extent are demonstrations of the value of this.

Five years ago provision was made for admitting to the Society associate members, who should be interested in municipal supplies from a business point of view. A few such have read before us papers descriptive of their specialties, which have been of great general interest; but even to these the title associate member has not been applied, and nothing further seems to have been done in the matter until this year, which was unfortunate, as it is our duty to our several municipalities to know the latest and best in materials as well as in methods. The exhibition which is this year presented for our inspection is the first fruits of an endeavor to acquire associate members and make use of them for our good—and we hope for theirs also. There are undoubtedly many ways in which this exhibition could be improved. It is hoped, however, that the idea will be generally recognized as so beneficial to all that our associate members will decide to organize and arrange among themselves next year for a more complete and satisfactory exhibit than this first one can hope to be.

In retiring from the presidency of the Society I desire to thank you for the most cordial and untiring support which so many of you have given me in my efforts for its good, and to congratulate you most optimistically upon the outlook. If so much can be acomplished by so few in one year, what is not possible for the future with an increased and increasing number of workers? But continuous and long continued effort is required; continuous, that the delayed benefits of one year's work be not lost through failure the next year to exert the lesser efforts required to gather them in. It is my hope that I may have the honor to be past president of a society vastly larger and more influential than that whose presidency I am now about to resign to another, but whose interests I shall not therefor have the less at heart.

THE PRESIDENT: The next business before the Association is the report of the Secretary.

Is Mr. Tillson prepared to let us hear his report at this time?

THE SECRETARY: Yes, sir.

THE PRESIDENT: Immediately following the report of our Secretary, we will have to deal with the Treasurer's report. I suppose we might as well take the two of them together.

REPORT OF THE SECRETARY.

BROOKLYN, N. Y., Sept. 1, 1905.

American Society of Municipal Improvements:

GENTLEMEN: I herewith submit my report for the year ending September, 1905:

Receipts—	
Dues and entrance fees	$601.50
Sale of reports	49.25
Total	$650.75

Paid to Treasurer—	
1904.	
October 6	$140.00
November 9	161.25
December 3	26.00
1905.	
January 12	15.00
March 2	40.00
April 4	73.00
May 1	32.00
June 20	35.25
July 31	25.25
August 2	97.00
	$644.75
In hands of Secretary	$ 6.00
Total	$650.75

The expenses of the office for the year have been as follows:

Express	$3.70
Postage	15.65
Printing	9.25
Telegrams	1.69
Rubber stamp	.15
Total	$30.44

On account of the arrangements authorized by the Board of Directors and the Executive Committee, the proceedings of the last meeting have been issued without any cost to the Society. The demand for the Society proceedings has continued during the past year, as will be seen by the receipt from the sales.

All correspondence of the Society has been attended to, and a separate acount kept of each and every member. Notices have been given to the members of the proposed meetings, in accordance with the Constitution. At the meeting of the Executive Committee last year five members were dropped for non-payment of dues. During the year three members have resigned, one, Mr. G. Bouscaren, Chief Engineer of Water Works, Cincinnati, Ohio, has died, and Mr. Robert Allison, Board of Public Service, Cincinnati, died in March, 1903, but the Secretary was not notified until

1904. At the last meeting of the Society fourteen new members were elected, so that the net gain for the year has been five.

The Secretary wishes to express his thanks to all the officers and members of the Society for their co-operation during the year.

Respectfully submitted,

GEO. W. TILLSON,

Secretary.

REPORT OF TREASURER.

OSWEGO, N. Y., Sept. 2, 1905.

To the American Society of Municipal Improvements:

GENTLEMEN: I have the honor to submit the following report of Receipts and Disbursements for 1904 and 1905:

RECEIPTS.

Balance Oct. 1, 1904	$432.08	
Oct. 11, from George W. Tillson	140.00	
Nov. 11, from George W. Tillson	161.25	
Dec. 2, from George W. Tillson	26.00	
1905.		
Jan. 12, from George W. Tillson	15.00	
March 2, from George W. Tillson	40.00	
April 5, from George W. Tillson	73.00	
May 1, from George W. Tillson	32.00	
June 20, from George W. Tillson	35.25	
July 31, from George W. Tillson	25.25	
August 25, from George W. Tillson	97.00	
		$1,076.83

DISBURSEMENTS.

1904.	
Oct. 25, G. W. Tillson, expenses secretary's office	$40.87
Oct. 25, F. J. O'Brien, expenses treasurer's office	12.75
Oct. 25, George P. Coles, 200 pamphlets	20.00
Oct. 25, George M. Ballard, stationery and postage	4.00
Nov. 12, George W. Tillson, salary Sec. 1903-04	100.00
Nov. 12, Mary Burke East, reporting Convention	37.00
1905.	
Feb. 7, Free Press Pub. Co., circulars	8.75
March 4, The Brooklyn Citizen, printing	18.50
May 6, Free Press Pub. Co., circulars	8.50
May 16, The Hartford Printing Co., letter heads	3.25
July 14, Free Press Pub. Co., printing	34.00
Aug. 25, George W. Tillson, disbursements Sec.	30.44
Aug. 28, William C. Everhart, freight and cartage	3.78
Aug. 28, Free Press Pub. Co., circulars	8.00

Aug. 28,	A. Prescott Folwell, disbursements as Pres't..	$22.37	
	Exchange on checks received.................	2.70	
	Balance Sept. 2, 1905........................	721.92	
		———	$1,076.83

Yours very respectfully,
F. J. O'BRIEN,
Treasurer A. S. M. I.

THE SECRETARY: I would suggest, Mr. President, that the report of the Secretary and the report of the Treasurer be referred to the Finance Committee.

Which, being duly seconded, was agreed to.

THE PRESIDENT: Are there any Special Committees prepared to report at this time?

According to our Constitution any amendments must be submitted to the Association on the first day of the annual convention, so, if there are any proposed amendments they should be placed before us today in order to follow out the Constitution.

THE SECRETARY: Two amendments have been suggested, Mr. President. The first is to Article II, and consists in striking out the last sentence of the first paragraph in section 1, leaving it to read: "Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work."

The second amendment deals with Article III, and consists in striking out the entire article and replacing it by the following: "Each corporate member shall pay five dollars per annum as dues; and each associate member ten dollars per annum. All dues to be payable in advance on or before the date of the annual meeting."

This is practically the way the business is carried out now, and the amendment was suggested to conform to our practice.

MR. SHERRERD: Would it be proper to refer those proposed amendments to the Executive Committee?

THE SECRETARY: They come from the Executive Committee.

MR. SHERRERD: Does the Executive Committee recommend that those changes be made in the Constitution?

THE PRESIDENT: They are submitted to the meeting today, and they will be acted on later. We will deal with them at the last session of the meeting.

The next matter that we have before us is the selection of a Committee on Nominations and also a Committee on the Place of Our Next Meeting.

We will first take up the matter of the appointment of a Committee on Nominations. According to the Constitution this committee has to be appointed today. I think the custom has been to appoint five members, and I would be pleased to have the meeting suggest the names of five gentlemen to serve on this committee.

The following gentlemen were proposed and appointed as members of the Nominating Committee: Messrs. M. R. Sherrerd, C. H. Rust, E. A. Fisher, John R. Barlow and William Fortune.

THE PRESIDENT: We will now proceed with the selection of the Committee on the Place of Our Next Annual Meeting. There are five members to be elected to this committee.

MR. SHERRERD: Would it be in order to nominate the executive officers of the Society for this duty. It seems to me that they would be in a better position to decide on what is best than any other committee that we could appoint.

THE PRESIDENT: There are times when certain members, who are not on the Executive Committee, like to think that they themselves, or their friends have a say in some of the matters of interest to the Society, and personally I must say that I approve of the plan of nominating a separate committee for the duty of deciding where we shall hold our meetings.

MR. SHERRERD: That did not occur to me, Mr. President. I agree with you entirely.

The meeting then appointed Messrs. Pollock, Vincent, Grosser, Barrow and Freshney as members of the Committee on the Place of the Next Meeting.

THE SECRETARY: I wish to say that the Engineers' Club of Montreal and the Canadian Society of Civil Engineers have extended to us the privileges of their respective organizations, and hope that the members of this Society will pay them visits during our stay here.

I also have an invitation from the trustees and faculty of the University of Illinois to send a representative of this Society to attend the installation of Edmond Joseph James as president of that University. The installation is to take place on the 19th of October, 1905.

I have a letter from the Mayor of Chicago asking that the next meeting of the Association be held in that city, and a letter from the Bedford Springs Company, asking that the meeting be held at Bedford Springs. I would suggest that those two letters be referred to the Committee on Place of Meeting.

MR. SHERRERD: I would move that the Secretary be instructed to tender the thanks of the Society to the different organizations which have extended invitations to us.

MR. CRANDALL: I would like to suggest that the matter be referred to the Committee on Resolutions, and they can prepare resolutions, and submit them to the meeting. The matter will then be properly attended to. I would suggest this in amendment of Mr. Sherrerd's motion.

MR. SHERRERD: I agree with Mr. Crandall. That would be a better way of dealing with it. I will withdraw my motion, and second Mr. Crandall's instead.

THE PRESIDENT: As there are a great number of resolutions of thanks which it will be our duty and pleasure to pass, don't you think it would be better to do it at once, and have the Secretary acknowledge the invitations of the local societies, and the University of Illinois, with the customary thanks of the Society?

MR. CRANDALL: I think it is a much simpler way than mine.

Which, being seconded by Mr. Sherrerd, was agreed to.

THE SECRETARY: Regarding the invitation from the University of Illinois, I would move that Professor A. N. Talbot, who is a member of this Society, be delegated to represent us at the installation of their new president.

Mr. O'Brien: It seems to me that it would be better if some past president of this Society were chosen to represent us.

Mr. Sherrerd: Why could we not have Mr. Folwell, our worthy president. represent this Society at that function?

Professor Talbot belongs there, and Mr. Folwell does not, but would go there especially to represent this Association, whereas Mr. Talbot may have other duties to attend to.

The Secretary: I did not mean to confine it to Prof. Talbot. I simply wanted to be sure that someone would be there as a delegate from this Society.

The President: I doubt very much whether I would be able to go. I think it might be well for us to nominate some gentleman who is on the spot.

The Secretary: Of course Professor Talbot would not represent the Society without some authority to do so.

Mr. O'Brien: Perhaps we might have a little more representation. The Professor is a member of the Faculty, and will have to fill his place as such, therefore he would not be in a position to represent this body in the eyes of the public as well as someone who is not so closely connected with the university.

I think that some past president of the Society should be appointed to represent us—leaving it to the Executive Committee, perhaps, to decide just who our representative shall be.

Mr. Brown: I move, Mr. President, that yourself, and the Secretary and Mr. Talbot be appointed to represent this Society at the installation of the new President of the Illinois University.

Which, being seconded, was carried.

Mr. Grosser: I would like to add to that motion a clause to the effect that the expenses of the representation be borne by the Society.

Mr. Brown: I will accept the amendment, and am pleased to have it form part of the main motion.

Mr. Johnston: It seems to me that we are asking for a rather large delegation, and that this is a lot of expense for us to go to in order to attend the installation of the president of a college.

The President: Possibly it was not implied, but it was my understanding that one gentleman is already on the ground, and the idea of appointing the other two was that if one could not go the other would.

Mr. Grosser: Might I say a word, Mr. President. This function does not take place in Chicago. It is the installation of the new president of the State University of Illinois, at Urbana, Ill., and it is being made a very great affair, and all societies of public standing have been invited to attend that installation. It seems to me that a representation from this Society, at such a function as that, will certainly accrue to the benefit of this Society as a body. As the old saying goes, "It pays to advertise," and the presence of a committe from this Society on that occasion will certainly advertise this organization, if it does not do anything else.

Mr. Johnston: I have no particular objection to sending a representation, but it struck me, at first sight, that we were sending too large a committee for such a function.

The President: I am informed that the maker of the motion intends that only one member shall attend the installation, and that the committee was made of two in order that one would be sure to be there.

If there is no further business to come before the meeting we will now proceed to the reading of the papers.

The first paper is the report of the Committee on Municipal Data and Statistics. Mr. William Fortune, Indianapolis, is chairman of this committee.

To the President and Members of the American Society of Municipal Improvements:

Gentlemen: The Committee on Municipal Data and Statistics presented last year the forms adopted by the U. S. Census Bureau for collecting statistics of cities, and that bureau publishes almost simultaneously with this meeting the first installment of statistics, being those collected from cities of more than 25,000 inhabitants.

Mr. L. G. Powers of the Bureau of Statistics in the same U. S. Department of Commerce and Labor in a resent address calls attention again to the need of some uniformity in methods of accounting and reporting, as shown by the difficulties which the agents of the statistical bureaus find in securing the returns called for by their blank forms. It is necessary for an agent to visit every city in order to get together the material necessary to fill the blanks properly and completely and it is not then possible in the limited time to which can be spent in any one city to unravel all the puzzles which are found, so that there are frequent failures to reduce data to the same terms, and it is consequently not always safe to make comparisons of details too closely. One must know personally something about the methods in use in the cities he wishes to study before he can know how closely the data in the census reports conform to a common standard.

The forms of report which this committee has heretofore presented for the approval of this Society would be of some assistance to the Census Bureau if their adoption could be brought about. They have been carefuly worked out so that they can be used with any real system of city accounts, but many cities would find it necessary to make collections of data from various city offices in order to use the forms of report in full. Should the forms be adopted, the first year would require much work, but when the locations of data and methods of getting them together, and officials to be responsible for the work have been determined, later years would require much less attention. This is shown by the experience of water departments in adopting the standard form of reports of operations of water works. It is seldom that the use of this form is discontinued after it has once been adopted.

The long campaign for the adoption of this one form, carried on mainly by the New England Waterworks Association, is gradually bearing fruit. This campaign has included a liberal distribution of printed copies of the forms among water works companies and departments and some personal work. If this Society is to have any success in securing the adoption of the forms which it has approved, it must do likewise. No progress in the adoption of the forms can yet be reported. Not one city which is a member of this Society has paid the slightest attention to them, and no one outside of it seems to have the slightest knowledge that they are in existence. The experience of the New England Waterworks Association was the same at the beginning of its agitation, so that there is no great surprise in this failure. It only emphasizes the fact that the members of the Society must be familiarized with the forms, as well as officials of other municipalities. This can only be done by presenting the forms in shape for distribution in the departments where they are needed. If the funds can be spared for this work, this committee recommends their publication in separate and convenient form. This will remove the only possible objection of members of this Society to the consideration of these forms—that of ignorance of them. These forms were prepared as the result of complaints from members of the Society of the lack of comparable data. They certainly should be used by those who have made these complaints as their contribution to the work of securing uniformity. They can scarcely complaint of others if they are not willing to do their share. The forms must be satisfactory, or they would not have been unanimously adopted after some three or four years opportunity for study and criticism. The reform must begin at home, if it is to begin anywhere.

It does not seem possible to change methods of accounting without action of state legislatures. Ohio now has a uniform system of accounting which has been presented by a state accounting department. Inquiry among city officials shows that for the first year or two there was much trouble and dissatisfaction, but after the system is once established in a city it is very satisfactory. The only complaint then arising is that the state department exercises too close a censorship upon payments and does not allow accounts which it considers advisable to reject. For example, the propriety of payment of the expenses of delegates to such a convention as this is questioned by the state department, and it is said that some such payments have been disapproved. This interferes with the principle of home rule and somewhat stretches the principle upon which the state department of accounts is founded, namely, that of looking after the form and manner of acounts and watching for errors and dishonesty in officials. Any account which has been approved by the proper municipal official or body should not be subject to the disapproval of the state department. The publication of the reports and of the comments of the department is all the check on the public action of the municipal officials which can be permitted without undue interference by state officials in local affairs.

The municipal reports received from Minnesota, Wyoming and California give evidence of similar laws in those states. Such laws should be encouraged elsewhere. The usual objection made to them is regarding the expense of the state department, but this has been shown by experience to be unfounded, as the expense is very slight. In comparison with the benefits derived it is not worthy of consideration. If the state department is not given power of too rigid censorship of appropriations by city councils, there are no other objections which are not offset many times over by the savings in errors and in defalcations and in the increased attention to the propriety of making appropriations which comes from the certain publication of all financial transactions in a form which reveals all their benefits and their iniquities.

Respectfully submitted,
WILLIAM FORTUNE,
Chairman.
H. W. WILMOT.

MR. FORTUNE: I wish to add verbally that I think the greatest progress which has been made during the past year was the work adopted under the direction of Mr. Wilmot (who is a member of this Society) in the City of Minneapolis. There they have devised forms that are considerably in advance of anything that has yet been offered. They have accomplished what was said to be impossible in Minneapolis, and what is still regarded as impossible in many cities, and that is a trial balance of municipal accounts.

Mr. Wilmot has prepared a paper to present to this meeting, in which he deals in detail with the work that has been accomplished.

THE PRESIDENT: Mr. Fortune's report is before the Society for discussion, and I wish to say right now that I hope the discussions of the several papers will be free and full. I think a paper is specially interesting for the discussion it brings out, and the discussion is frequently as valuable as the paper itself. I trust that all the members will feel free to discuss the papers fully and thoroughly.

MR. REIMER: I have not charge of the water department of East Orange, New Jersey, but my son has, and I would like to know whether one of the reports ever got there. I have not seen them.

THE PRESIDENT: They have been published in the proceedings twice, I think.

MR. FORTUNE: They have been published in the proceedings. This committee has not sent out reports specially to any department of city government anywhere, therefore it has not been brought to the attention of the heads of departments unless they found it in the reports.

MR. GROSSER: Mr. President, you will pardon me, as one of the youngest members of the Society, if I take part in the discussion, but this is a subject in which I am particularly interested, and to which I have given a great deal of thought during the last five years.

I did not know of the existence of a system of schedules for city reports, and was very agreeably surprised when Mr. Fortune informed me yesterday that there was such a schedule in existence.

I would like to suggest this. As Mr. Fortune pointed out in his paper, the existence of those schedules is of no earthly benefit to anybody unless we can make those schedules work, and the suggestion thrown out by Mr. Fortune that they should be distributed all over the country appeals to me as being a very good one.

I will go further than this, and say that it will be possible to get a uniform system of reports only if we compel each member of a municipality to go to work along certain lines, and the only way to do that is to add our influence and "pull" with our councils and have them adopt that schedule by ordinance. In this manner we can compel each city official to make his reports along the lines desired.

If we try this, and it works successfully, I am sure that next year a number of cities will be in a position to render reports along the lines laid down.

I will say further that a great deal has been said about the uniform system of accounting. I do not like this expression. I think it is a misnomer. So far we have achieved nothing except a uniform system of bookkeeping (which is not accounting by any means). Financial accounts have been made uniform, as Mr. Fortune has pointed out—Minneapolis has an excellent system, so has Chicago, so has St. Paul and a number of other places, but a great many of them have arranged their financial accounts according to the system recommended by the National Municipal League. That is one of the things that the Municipal League has achieved.

The City of Chicago has expended over seventy-five thousand dollars in introducing a new system of financial accounts. I just mention this as an instance of what the municipalities are willing to do when they see what they consider a good thing.

I have spoken before the National Municipal League Convention, and have been in communication with a good many city officials, always to the effect that in order to make those financial accounts of value to cities for comparative purposes it is necessary to connect with the financial accounts an account of the services rendered, for it is only by comparing the two that you can find any equitable basis of comparison between two cities.

It does not mean anything for the City of New York, for instance, to say that they expended five million dollars for street cleaning, and the City of Chicago to say that they expended about three hundred thousand dollars. It is necessary to show the amount of cleaning that was done—the character of the cleaning that was done, and the character of the streets upon which the cleaning was done. If this is shown, then we can measure the thing up and compare one thing with another.

I believe that this Society, more than any other, is called upon, and is particularly equal to introducing just such improvements as have been mentioned.

Mr. Powers, in his paper at Toledo, maintained the same thing.

I keep in my possession all the reports of different cities, for purposes of comparison, and I may tell you right here that no one appreciates the advantages and difficulties of comparison more than I do.

I am very frequently called upon to compare the work and the expenditure of one city with another ,and it is a tremendous job. I undertook it once and was at it for three months before I was able to get it out.

Speaking from that experience, I say that the aim of this Society ought to be towards the end of getting those schedules issued and adopted for city reports, and that they should show, in addition to the amount of money expended, the amount of work performed, and the nature of the work. If you get those two together you will have a perfect system of accounting.

Perhaps I might suggest that each member of this Society, on going home, should bring the matter before his council (or whatever the executive body of the city is called) and have them pass an ordinance adopting this as the official system of reporting.

You all know the amount of information you generally get from the report of an engineer which you pick up. You will read that twenty ditches have been cleaned out here, and a small bolt has been replaced there, and a wall has been whitewashed in some other place, or some pumping has been done, or the pumping station has been repaired. For page after page you will read such stuff as that—which is of absolutely no use to anybody. It does not show the amount of work done, nor the nature of the work. A great many places have such reports as this—Chicago is not one of them.

Six years ago we established a Bureau of Statistics, and the duty of that bureau is to publish every quarter a publication called "City of Chicago Statistics." In this we give the reports of every department of the city's government. It is published in monthly columns, showing the amount of work done, the nature of the work, and what it cost.

Take for instance the item "Street Cleaning." We show this by wards. We show the amount of street dirt removed, in loads. We show the cost of this work. The system is not quite perfect yet, but we are working to perfect it.

In this bureau we cover every department, as I said, and there is one improvement that we have made and that is this—in former years the man in charge of the street cleaning would simply make up his report at the end of the year, and say, "During the year we cleaned eighteen thousand miles of streets." But there was nothing to show what sort of streets they were, or how they were cleaned, or anything more than the mere statement that eighteen thousand miles of streets were cleaned.

To-day in Chicago (although it may make you smile when I talk of street cleaning in Chicago, for it has been the custom to heap shame, and everything else on Chicago for its clean streets) we have a system by wards, and special forms upon which the men report the amount of cleaning, and the manner in which the cleaning was done, the character of the street and the cost, the number of laborers employed, and the number of teams employed. I am one of those who maintain that the streets of the City of Chicago are just as clean as those of any other city—in the business center.

What I have said about street cleaning also applies to garbage. We have no contract work, outside of the garbage removal, which is by contract.

We have not perfected our system yet, but we are getting there, slowly. I think some such system is one of the most potent features in preventing mismanagement, because it provides for publicity, and in my opinion publicity is a cure for practically all municipal evils.

Mr. Sherrerd: The chairman of the committee referred to the condition of things in Ohio, where the question of paying the expenses of the delegates to the different conventions was brought up. I think the report intimates that the use of those forms brought that question up, if I understood it well.

Mr. Fortune: It is an Ohio system where the state exercises a supervision over the local accounts.

Mr. Sherrerd: It came up at the meeting of the American Waterworks Association. This subject was dealt with and we found that it was questionable, under the laws of the State of Ohio, whether the expenses of delegates could be properly audited by municipalities.

I would like to say for the information of any of our members who may be from Ohio that we have been promised the co-operation of some of the members of the Central States Waterworks Association and the American Waterworks Association in the endeavor to have a law passed which will enable municipalities to audit the expenses of delegates to conventions, under proper supervision, of course.

Mr. Grosser: If I might again trespass, Mr. President, I have a question that I would like to ask. I did not quite understand the position. Does the committee recommend that the state have control of the accounts?

Mr. Fortune: Not to the extent of disapproving of the accounts. Simply a supervision over the forms.

Mr. Grosser: I am sorry to have to ask the Chair for permission to speak a second time. I desire, however, to give you my opinion on that, in a very few words.

I am a firm believer in home rule. Every city ought to know what it can do, and what it cannot do, and it should not be informed of this by anybody else. I think that is a matter for each city to know for itself.

I do not believe in supervision on the part of the state. I do not see that it can benefit the position. It has not done so in the case of Ohio, so far, and it does not look as though it will. The accounts are not in much better shape than they were before.

MR. FORTUNE: I think that this would be as good a time as any for Mr. Wilmot to contribute his paper on this subject. I am sure that he can give us something of great value. I think that he has had more experience in this line than any other man in the country, and has had some very valuable experience recently.

It seems to me that this is the time for us to hear from Mr. Wilmot.

MR. WILMOT: I am afraid that Mr. Fortune has rather exaggerated the experience that I have had. It is true that I have been "up against" one or two cities in my time. I agree with Mr. Grosser as to the larger cities, such as New York, Chicago and Minneapolis, but the trouble with Mr. Grosser is this, he is away ahead of anything that cities have even began to dream of yet.

In the first place you will agree with me that cities must know how to keep a cash book, and I tell you frankly that they do not even know how to do that. I could tell you of a city whose accounts my firm has straightened out, and whose books had never been balanced before that. There was simply a list showing how much cash was received and how much was paid out. There had never been a trial balance.

The idea of the comptroller of the City of Minneapolis was simply that he had received so much and paid out so much. The charter of the City of Minneapolis was an extremely complicated affair, and his idea was the idea of an old woman—so many apples, so many cents. He had absolutely no notion of what his outstanding liabilities were, nor had he any idea of what his credits were.

With this introduction I will proceed with the reading of my paper.

MUNICIPAL ACCOUNTING REFORM, AS ILLUSTRATED IN THE CITY OF MINNEAPOLIS, MINN.

BY H. W. WILMOT, C. P. A.

Preliminary. Correct methods of accounting play so large a part in the efficient administration of cities that the question of reform in this direction appears quite appropriate for consideration at these meetings.

It is generally admitted by students of municipal finance that the accounting methods of most cities of the United States are deplorably behind the times, and that similar methods could not be tolerated for a day in any successful commercial corporation. These methods may possibly have met the local requirements when the cities were smaller, but as municipal affairs have become more complex the multiplication of matters to be recorded has rendered these antiquated accounting systems entirely inadequate.

Not in one case in a hundred is it possible to present promptly those periodical statements during the fiscal year which are as necessary for the guidance of city officials as for the directors who manage the affairs of large industrial corporations, and the annual reports of comptrollers and treasurers do not afford intelligent citizens the information they require in order to form an opinion as to whether the administration has been successful or unsuccessful.

Reports are needed which shall render it possible for the public to obtain an insight into municipal finance, and which shall also portray accurately the financial condition of the various classes of cities.

A general balance sheet or a statement showing the financial position of the various legal funds is a rare thing in city reports, while a scientifically classified revenue and expense account, of the city and its various funds was, until recently, almost unknown. The cost of public utilities owned by the city and the correct results of their operation are seldom ascertainable. Correct information is often lacking even as to the amount of uncollected taxes or as to whether appropriations have been over or under expended.

Example of Minneapolis. As the text of this address it is proposed to take the practical example of accounting reform afforded by the City of Minneapolis, the results of which are illustrated in the financial report of that city for the year 1904 (a copy of which you have before you).

Minneapolis was one of the first cities to realize the importance of introducing into its various departments comprehensive methods of accounting, and the financial report for 1904(though by no means perfect), is of more than local importance in that it exemplifies certain principles of accounting which, if generally adopted, would considerably assist in the solution of some important financial problems in city government and finance.

The report is based on a system of accounting devised to comply strictly with the requirements of a complicated local charter. In accordance with the special desire of the city council it also follows the classification of expenses called for by the uniform system of municipal reports and statistics adopted by the United States Census Bureau.

Results of Inadequate Accounting Methods. Prior to the installation of the new system, the accounts of the city were kept strictly on a cash basis, with the result that they drifted into great confusion.

In order that the experience of Minneapolis may be available for others, the folowing remarkable examples are given of the result of this method of recording cash trasactions only:

(a) The deferred assessments which stand in the balance sheet at over $1,000,000 did not appear anywhere on the books of the city, while the uncollected taxes—of which only a memorandum was kept—were stated at some $376,000 greater than the amount shown by the detailed tax lists.

(b) It was impracticable to ascertain from the books what property was owned by the city or the cost thereof, and no reliable figures could be produced to justify the present indebtedness of nearly $10,000,000.

(c) While the accounts of the city were kept on a cash basis and the liabilities were dealt with only when paid, it was impossible to tell from the books the exact position of any of the fund created by the city charter. An examination of the books by public accountants brought out the fact that there was a deficit in several of the funds perhaps the most startling example being that of the permanent improvement revolving fund amounting to over $560,000.

This fund was created by means of a bond issue for the purpose of enabling the city to make certain improvements, the cost of which would be recovered by special assesments spread over a term of five years.

The city charter requires that as installments of assessments are collected the money shall be used for further improvements of the same nature, which will in turn be assessed. As the installments are collected they are to be again expended, and so on—hence the name "Revolving Fund."

For the fund to be kept intact there should always exist assets to offset the liabilities. These assets should be made up of:

(1) Installments of special assessments not yet due.
(2) Special assessments due and uncollected.
(3) The cost of uncompleted improvements which on completion will be assessed against the owners of abutting property.
(4) Supplies on hand purchased through the fund.
(5) Cash on hand applicable to the fund.

It will readily be seen from the number of elements which constitute the fund that no proper accounting can be had if only cash receipts and disbursements be dealt with and no account taken of the assets which will be ultimately converted into cash applying to the fund.

The necessity will also be recognized of agreeing the special assessments levied with the actual cost of the improvements. No complete cost system was kept in the engineer's department nor, in fact, was there any connection between the comptroller's and engineer's books.

There was no means of ascertaining that the actual cost of the improvements was assessed, nor whether all the assesments were collected and the proceeds turned over to the treasury.

This method of accounting was carried on for many years, until at last the city officials were confronted with the fact that there was not sufficient cash left in the fund to provide for necessary current improvements, and it is impossible at this date, without a lengthy investigation into the transactions of past years, to say how the deficit arose.

(d) A number of appropriations were over expended, but the fact was not disclosed by the old system of accounting. For example—Liabilities for street lighting were incurred during the year 1904, amounting to $226,940.10 as compared with an appropriation for this purpose out of the current expense fund of $200,027.00, thus leaving liabilities of the 1904 administration to the extent of $26,913.10 to be met by the next administration in 1905.

To relate the difficulties which had to be overcome in order to bring order out of this chaos would be out of place, but from the above remarks it will be seen that one of the main objects of the reform was to abolish the old cash system and replace it by a system which would continuously record all income arising from tax levies, water rents, etc., and introduce all obligations incurred on account of purchases and expenses as they accrue to be carried as assets and liabilities respectively until collected or paid, or otherwise properly disposed of.

The deduction should not be drawn from the above illustrations that the financial arrangements of Minneapolis have been more than ordinarily lax. Examination of several other cities has shown that even greater financial confusion frequently exists, and it is believed that similar experiences might be expected in a majority of cities of similar size.

Check on Revenue and Expense. In a city of the size of Minneapolis, one of the essentials of a system which is to afford a check on the collection of revenues and on the incurring of expenses is the proper recording of every bill immediately a demand in favor of the city comes into existence, and of every requisition for expenditure as soon as it is authorized.

If this recording be systematically attended to by a competent comptroller the information can be used as a basis of account books showing the city's resources and liabilities and should afford the means of preventing waste through carelessness or graft.

These books will contain all the revenues which pertain to the year, and the actual expenses incurred during the year for current administrative purpose, irrespective of whether such revenues and expenses have been actualy collected or paid. Thus, the taxpayer of one year will not be made to pay the obligations which ought to have been met out of the income of the previous years, nor will it be possible by the holding back of claims over the close of the fiscal year to throw the necessity for an increase in taxes on the next administration. At least, if these conditions do arise they will be disclosed by the acounts and should be reported by the comptroller to the taxpayers in his published annual report.

Centralization in Office of Comptroller. Much discussion has taken place as to the scope and power of the comptroller; whatever doubt there may be as to the advisability of giving him power to interfere in questions of policy or administration there can be no doubt as to the wisdom of concentrating in his hands the departments of finance and accounts, in order that the accounts and reports of all sections of the city government shall be in accord.

The general accounting system in the comptroller's office should embrace the financial records of each of the departments which incur expense or to which income accrues and which keep books of accounts. These in turn should fit in with those of the comptroller. This coordination of departmental records with the general system is particularly needed in the case of the department of public works when a city undertakes its own construction, otherwise, as has already been pointed out, there is risk of confusion between the special assessments and the cost which they are supposed to cover.

Such an agreement can readily be arrived at if the comptroller adopts a system of governing accounts with the various departments, charging the several departments in total with the expenditures incurred by them and leaving the detailed analysis or classification of these expenditures to be kept on the departmental books, subject to his audit.

The process of introducing methods centralizing authority necessarily involves a vast amount of labor under conditions by no means pleasant. The heads of the departments usually appreciate the necessity for reform in all other departments except their own, and their jealousy of their own dignity and resentment against any suggestion of supervision, even in accounting matters, render the work of weaving together the old disjointed systems of the various departments a difficult matter.

It is fair to say that in Minneapolis, after the reforms had been thoroughly explained and understood, they were cheerfuly adopted. The changes were made without confusion in the conduct of the city's affairs and the detail operations of the new methods have since been carried out without friction.

Economies to be Effected. The question will naturally be asked whether economies are likely to have been effected by the institution of the new system.

So far as the actual expense for clerical help is concerned there may be no saving. Considerable economy can, however, be effected through the placing of the means of supervising the expenditures of the various departments and the collection of revenue in the hands of a capable and honorable comptroller, who will be in a position to detect fraud and graft and to supervise the collection of revenues which, through carelessness or fraud, would be otherwise lost to the city.

In the case of Minneapolis it may be safely stated that, owing to the closer supervision which the new system renders possible, and the consequent reduction in losses through uncollected revenues and the elimination of erroneous duplication of the payment of claims, the revenues of future years will eventually be found to have increased considerably over those of previous years.

If the system be properly carried out it will be impossible for any shortages similar to that in the revolving fund to occur again, and the close supervision will have a healthy effect on those responsible for collecting and disbursing the revenues of the city.

General Balance Sheet December 31, 1904. In the light of the elementary principles of accountancy dealt with above, viz.—the recording of revenue and expenses and the centralizing of control in the office of the comptroller—the main features of the Minneapolis balance sheet, December 31, 1904, may now be pointed out:

It will be noted that this statement which exhibits the financial position of the city as a whole is divided into two sections. The upper section contains only the capital assets and liabilities, *i e.*—the fixed properties, the current assets to be ultimately converted into fixed properties, the sinking fund assets, the bonds which will ultimately be liquidated through the sinking fund, and the certificates of indebtedness and accounts payable arising out of the acquisition of fixed properties. The difference between the capital assets and capital liabilities is the capital surplus and represents that portion of the value of the fixed properties which has been acquired by the city out of taxation.

The lower section of the balance sheet includes only the current assets and liabilities, *i. e.*, those applicable to the expenses of administration and maintenance and not to the acquisition or improvement of fixed properties. The difference between these assets and liabilities, which is shown as the revenue surplus, represents the unexpended portion of the revenue of the city and is represented mainly by uncollected taxes.

A common defect in the reports of even those cities which publish ample data is that the information is so scattered and badly referenced that it is almost impossible for a layman to put together a comprehensive statement. It should always be the aim of the comptroller to present a set of accounts which can be readily understood by the average business man.

This has been accomplished in Minneapolis by the presentation of a general balance sheet in the ordinary commercial form—supported by a columnar statement showing a condensed summary of the assets and liabilities of each distinct legal fund. The reference on the face of the general balance sheet indicate that all the items grouped under the different heads are given in detail in subsequent tables.

The financial statement of funds immediately following the general balance sheet shows the segregation of the assets and liabilities between the specific legal funds to which they apply. The totals of this statement can readily be traced to the general balance sheet.

Classification of Capital Assets. In a city balance sheet it is desirable, if possible, to state the cost of all the serviceable property (that is, the property which is fulfilling the purpose for which was intended), classified under its main headings, with detail exhibits showing the cost, the present reproductive values and the depreciated values.

In actual practice some difficulty may be experienced in obtaining cost values of the permanent assets, and in many cases it may be necessary to take appraised values as a starting point. Such was the case in Minneapolis. The information as to the cost of fixed properties could not be obtained owing to the crude methods of accounting heretofore existing, while the present reproductive and depreciated values could not be given owing to the absence of a reliable appraisal, that made by the special committee not being sufficiently complete for the purpose.

It must be borne in mind that the balance sheet of a city cannot be read in the same light as that of an ordinary trading corporation. The main object of the balance sheet is not to show the possibilities of realization, but rather to afford information on administrative questions. The introduction, therefore, of the capital assets and the bonded debt of a city does not imply the possibility of the realization of city properties with a view of liquidating the debt in the commercial sense; neither can the current assets be assumed to offset in total the current liabilities in total, inasmuch as the distinction of funds must be maintained.

It is not to be assumed, however, that the administrative purpose is the sole detriment in fixing the form of the balance sheet.

One of the objects of the balance sheet should be to show bondholders and taxpayers what assets (realizable or unrealizable) are to be set against the debt.

For this reason the capital assets have been classified on the Minneapolis balance sheet so as to show:

(a) The property which could be sold, if desired, without interfering with the facilities already enjoyed, such as water works.

(b) The property which might be sold without hampering the city administration, but the disposition of which would involve a loss of convenience, such as parks, public buildings, etc.

(c) The property which it would be impossible for the city to sell under any circumstances, such as bridges, sewers, etc.

This classification has in the case of several cities found great favor with bankers in considering the placing of bonds.

The precise classification of the capital assets is not, however, of very great consequence, and if it be felt that the distinction between the second and third class set out above is somewhat fanciful the following alternative classification is suggested: (a) Public Industries, (b) Schools, Parks, etc., (c) General City Property.

The division of the bonded indebtedness into classes to correspond with the fixed assets is desirable where possible, but inasmuch as the records of Minneapolis do not show out of which bond issues the various properties were acquired, and also as the value of the fixed properties are based on a valuation and not on actual expenditures this division was found impossible in the case of Minneapolis.

Other items in the balance sheet do not call for special comment inasmuch as details are given where necessary in subsidiary exhibits.

The liability for interest accrued but not due on bonds has been omitted for the reason that the tax levy covers only the interest falling due within the year, and it was felt that the assets and liabilities should bear some relation to the revenue to be received for the acquisition or discharge thereof. Had the liability been brought into account it would have been proper to have anticipated an equal amount of the income of 1905 which would have been carried as a deferred asset in the balance sheet.

General Revenue and Expense Account. The General Revenue and Expense Account appearing in the Minneapolis report sets out the revenues and expenses classified according to the various functions of city administration in accordance with the plan adopted by the census bureau. Elsewhere in the report the revenue is distributed over the specific legal funds to which it applies.

No comment is necessary on the various headings of the revenue and expense account, but it may be pointed out that by means of subschedules the various classes of expenditure may be detailed so as to show, if desired, the name of the party to whom the smallest item was paid, so as to satisfy those taxpayers whose only desire is to know "who had the money."

Waterworks Revenue Acount. The Revenue Account of the Waterworks, which is the only revenue yielding property of the city, shows an operating profit for the year of $98,108.48. This operating profit, however, is arrived at without making any charge for interest on capital invested or for depreciation of plant, and before taking credit for water supplied to the various city departments.

It would be difficult, if not impossible, under the law of Minneapolis to incorporate as a part of the general system of accounting a revenue and expense account for the waterworks department as it should be, that is, as an independent concern, or to present a balance sheet exhibiting the surplus which would have been accumulated had the law permitted.

The city charter specifies exactly what should go into the waterworks fund and what should be paid therefrom. Nothing is mentioned regarding interest on bonds nor repayment of capital, and therefore it would be illegal to reserve anything from the waterworks income for this purpose.

The provisions of the charter need not, of course, prevent a memorandum account being prepared to show the operations of the water department on the same basis as if it were operated by a company, but unfortunately no information was available as to the quantity of water used by the fire and sprinkling departments, and this fact precluded the possibility of preparing such an account.

Correct Accounts Should Lead to Reform in Administration. In cities possessing complicated charters which create numerous legal funds for various purposes, it is a difficult matter to make the system of accounting conform to the classification of the uniform system of reports adopted by the census bureau, on account of the fact that this classification frequently conflicts with the local law.

The classification of the census bureau, however, has been devised after much thought by some of the leading economists of the country, and the demonstration afforded in the Minneapolis account of the conflicting points should prove most useful in the event of an amendment and simplification of the city charter.

For example—in Minneapolis, street repairs and grading are paid for partly out of the permanent improvement fund and partly out of each of 13 ward street funds. Street cleaning and snow and ice removed are also paid out of each of the 13 ward street funds, while each of these funds is available for the purchase of equipment, buildings, etc., for the use only, however of such wards as pays for it; that is to say, the funds of one ward cannot under the law be used for the purposes of another, nor is property and equipment purchased from the funds of one ward available for the use of another ward.

All the funds referred to are raised by special tax levy at different rates for different districts or purposes and must, by law, maintain their distinction.

The charter urgently calls for amendment in the direction of consolidation of these numerous minor funds.

When amendments of a city charter are under examination it will often be found advantageous to consider also whether the scheme of city administration cannot be simplified by so arranging that distinct functions of government should be performed by distinct departments or at least that one department should not perform duties which are usually accepted as belonging to another. For example—the bulk of the expense on "public highways and sewers" in Minneapolis is controlled by the engineer's department (which corresponds to the board of public works of other cities), but an item of $37,330.91 for refuse collection and disposal was expended under the authority of the health department and paid for out of the appropriation of that department.

Without here entering into a discussion as to whether the collection and disposal of refuse should be looked after by the department of public highways and sewers, or by that of protection of life, health and property, this lesson may be indicated, viz.—that on the occasion of a charter revision the light thrown by scientifically drawn accounts on the law on the one hand, and the form of city administration on the other, forms a valuable guide in reform.

Uniform Reports. In conclusion it is urged that cities when considering changes in their accounting systems or amendments of their charters should carefully study the census bureau forms and booklet, with a view to taking their share in introducing a uniform system of presenting municipal reports.

Great benefit would be derived from the general adoption of a scheme which permitted each city's experience to be compared with that of other cities. Such comparisons, if intelligently made and used by energetic reformers, would throw considerable light on such questions as to whether a city was being administered honestly and economically or dishonestly and extravagantly, and a comparison of the net existing assets would frequently explain large variations in the rate of tax levy between cities whose geographical and physical conditions were not dissimilar.

For the use of the administrative officers in the management of cities' affairs such comparisons should be as valuable as the comparisons of the accounts of one railroad with those of another are found to be by railroad managers.

From the point of view of a single city, a system framed to meet the local legal and administrative requirements and reports properly drawn up therefrom would probably furnish the executive officers of the city all the comparative statistics necessary for the economical administration of their own city, and accounts could be furnished the tax payers in such form as would enable them to compare the efficiency of one administration with that of another, but they would afford no means of judging of the economy or efficiency with which the city's business is transacted as compared with other municipal corporations which is the object sought by uniform municipal accounts.

MR. REIMER: This paper, and the discussion that preceded it, has been highly interesting to me, as no doubt it has to all of us.

I have only a little bit of a city, and ten years ago I was placed in charge of its street and sewer departments, not only as city engineer and street commissioner, but I had entire charge of those two departments. There had not been any kind of bookkeeping in either of those departments before I took hold of them, and I was a little surprised today to learn that I had anticipated some of the things which have been proposed here.

Our friend from Chicago, Mr. Grosser, has told us that now reports have to be made every day; well, I instituted just such a condition as that in our city just ten years ago, and have always found it to work well, and to be of the utmost advantage.

In our little place there are now about twenty-five or twenty-six thousand people, and we have thirty or forty miles of paved streets altogether, and a separate system of sewers. Every day I have a report handed to me from the foremen of the different departments. These reports show the work that was done and the number of men employed doing it, so that we know the whole thing straight through. This is all ledgerized, and the result of the system is that I am able to turn to almost anything that has been done during the past ten years and be able to tell you all about it—when it was done and what it cost. I can tell you what has been done on any particular street in the way of sewer maintenance, or street maintenance, or improvements of any kind.

While our system is far from being as perfect as our friend from Chicago suggested such a system ought to be, still, at the same time, I am satisfied that in some parts of it we are ten years ahead.

The President: As I said at the opening of the meeting, the discussions will sometimes bring out more points than the paper itself, without any detriment whatever to the paper, but, on the other hand which enhance the value of the paper. I hope that each and every paper will be discussed as thoroughly as the time at the disposition of the Society will permit.

We now come to the report of the Committee on Municipal Franchises. Mr. James Owen is chairman of this committee.

Mr. Owen: I found upon looking into the franchise question that there were two ways of looking at it, and two ways of handling it. One was in the way of the collection of data, and the other in the way of just giving conclusions.

I will simply allude to what may be considered the principles governing municipal franchises.

The committee has had two or three meetings in connection with this matter, and has delegated me to make one part of the report. Mr. John R. Barlow has a supplementary report to make, and when the reports have been presented to you, we will offer you our conclusions for your consideration.

MUNICIPAL FRANCHISES.

BY JAMES OWEN.

While the existence of municipal and other franchises is practically as old as the government, the subject until lately has not been one of particular general interest and attention to the matter has been confined to the special municipality in satisfying its peculiar wants. With the growth of the country, however, and the enormous expansion of municipal development the casual want of the past is now substituted by the universal need of the present.

To properly appreciate the gradual growth of the franchise problem it will be proper to note the specific items for which municipal franchises or charters have been asked and granted, and how they have been granted, and in this category will be included items, such as turnpike roads, that may hardly be considered a municipal development in the ordinary meaning of the word municipality, but they can not be consistently ignored.

It must be understood also that it would be practically impossible for one man to keep track of all the ramifications of the franchise problem on this continent, and specific allusion will be made to the section with which the writer is most intimate, viz., the metropolitan district of New York, but with its immense population, different states and different municipalities, the varied practices of that district may be taken as a sample of the whole, and what variation exists may be safely left to other members of this Society to dilate upon.

The particular items for which municipal franchises are granted are turnpike roads, water, canals, steam railroads, gas, horse car roads, steam heating, electric light and power, telephones, electric roads, surface, elevated and depressed.

Objections may be urged to the inclusion of steam railroads or canals in the above category, but their existence is so interwoven with municipal growth that they must be considered a factor in the discussion, and, furthermore, the steam railroads are becoming more and more a subject of municipal jurisdiction, both in the readjustment of lines and grades to the development of a city or town, and also in the constantly increasing extensions demanded for the collection and distribution of freight.

Taking the list as above, it will be noted that four of the items can hardly be considered as live subjects, viz: canals, turnpike roads, horse cars and steam heating, and these can be relegated to the past with the passing inquiry as to how many of the live items of today will soon be considered absolutely out of date within the next fifty years.

Looking back, however, and studying the growth and development of each one in the above list, it can be noted that the crucial point of municipal franchise granting was coincident with the introduction of electricity, and until that period arrived the municipality was but a small factor in the franchise question. Its permission was hardly asked, and while it was willing to approve any improvement paid for with extraneous capital, the returns to the capitalist up to that time were very uncertain, often meagre, and in many cases disastrous. In a few large municipalities the horse car paid dividends on their stock, but in many other cases it was difficult to meet interest on bonds and also to pay for extensions. The same rule applied to gas and water, but with the introduction of electricity the whole problem of municipal development seemed to change, and at the same time, or probably three or four years later, the citizens themselves began to sit up and take a little notice themselves of the situation, and today the best way of handling the problem is the subject of very grave solicitations.

From the early inception of the government all franchises were originally special grants by the legislatures of the different states, and these grants were practically monopolies. The idea of the people of that time was to encourage development through private capital, and every inducement and sacrifice was made by them to attain the desired end. In many cases the private capital was supplemented by drafts from the public treasury when failure seemed imminent, then, as the country grew and satisfactory return was received from previous investments, capital became bolder, made further invasions into the realms of municipal development, built water works and gas works and horse railroads, all with practically the tacit consent of the municipality affected, but with powers granted by the state which were often sufficient to overrule the local authorities, until suddenly a wave of protest swept through the country and general laws were passed authorizing with due and proper procedure the formation of the different companies for the different purposes with complete municipal control, with incidental state supervision.

It is interesting to note that in 1827 a charter was granted by the state legislature of New Jersey to build the Morris canal with a provision of reversion to the state at the end of a certain period. The period has not yet expired, yet it is a fact that the canal is useless, a burden to the owners, and it will be abandoned as soon as a satisfactory agreement can be arrived at. This case is one of the early germs of municipal ownership.

THE METROPOLITAN PROBLEM.

To more properly appreciate the problems of municipal franchise as a whole it will be necessary to take up each individual item in the above list and make a careful analysis of the peculiarities of each, with the trend of sentiment at present prevailing, and also with a regard to the future as is allowable with the average human foresight. When we note four items of our list wiped out of consideration it is certainly worthy of consideration what of the remaining may also suffer annihilation. There are also certain other governing principles affecting the franchise problem which must also be considered.

First—The homogenity of any community as to whether franchises are inherent or intramural, for example: New York city, with a population of 3,500,000, under one municipal control; Chicago, with a population of

2,000,000, under one municipal control; the New Jersey section adjacent to New York, with a population of 1,000,000, composed of 138 different municipalities; Boston and suburbs, with a population of 1,000,000, with twenty-five to thirty municipalities. These cases are cited as extreme, but they show the variations in conditions.

Second—Character of population—business, manufacturing, farming or residential.

A. Is business concentrated in one district or scattered?

B. In manufactures the proportion of labor to output is important.

C. Are residents scattered or congested?

Third—Topography and extent of the municipality.

Fourth—The average wealth taxable and actual.

Having outlined the subjects of the franchise problem, and also the principles affecting it, it will now be in order to make a specific application of one to another, and from that it will be possible to make deductions general in character, which may be of advantage.

TURNPIKE ROADS.

The era of private turnpike roads having passed, small allusion need be made; except to cite that they were all legislative grants, and on their abandonment almost uniformly reverted to the public; in some cases they were bought out by the local authorities; in others by the state, but the doctrine of municipal ownership in this case is well exemplified.

WATER SUPPLIES.

The practice of water supply on this continent is very varied. No one rule can be laid down for its application except that all large cities generally own their own supply, Indianapolis, Denver and Paterson being notable exceptions. The tendency of public opinion is, however, toward municipal ownership, and it can be noted that private plants are being condemned or bought out in every direction. On the one hand new companies are being formed in rising or growing towns, and at the same time other growing towns are putting in their own plants.

The topography and location of any given town is an important factor in its decision. A moderately large town near a large river with good water can easily afford to put in its own plant. Another town located near head waters would have to spend a larger sum for the same improvement, and it also occurs that a community is entirely dependent on an outside source for its supply. This source may be pre-empted by another municipality, so it is forced to buy. Then again the financial condition of a town may force it to get its water from a private company, or the inhabitants may be unwilling to raise the money . A water franchise as a rule is a permit to furnish water to a community at a given price paid by the consumer, with a bonus paid to the company for fire protection, known as hydrant rental. This varies from $60 to nothing per year, and in no case is it monopolistic. Practically, however, there is little duplication. The great onus in all water plants is to provide for extensions, which largely eats up the profits of private companies or necessitates continued increased capital, and the tendency of the courts to ignore franchise values in condemnation is having a deterring effect on private capital in water construction, so it is safe to premise that as time goes on the franchise problem in water supply will cease to be of moment. The duration of water franchises is as a rule indeterminal. The power of condemnation seems to be the solution of troubles between the company and the community.

The consumption of water per capita seems to be somewhat of a factor in the relation of company to municipality. When a variation of 200 gallons a head per day in municipal ownership to 25 gallons a head per day in private ownership is observable the problem of waste and free water arises in the franchise arrangement. Undoubtedly a large proportion of the waste is due to municipal neglect, but the doctrine of unlimited water is still a pervading sentiment and will not down.

As to the limit of the franchise for water service, very little discussion seems to have arisen. Where a company installs a plant and supplies the water to the consumer the franchises are generally perpetual, subject to a periodical renewal of the contracts for hydrant rental, and, of course, subject to condemnation. Where, however, a company furnishes water only, and the municipality delivers it to the consumers, the contracts are generaly terminal, and run from five to twenty-five years, with or without the privilege of renewal. Where a section is composed of many different municipalities it sometimes occurs that a company organized in one town will obtain its water from a company with a franchise in another town, and the periods of their contracts may vary, showing that there is no question of any prospective termination of their franchises. ,

CANALS.

Canals for navigation, owned by private corporations, are practically things of the past, and there seems little prospect of any future development in this line. Many of them have been abandoned and the land has reverted to the owners, others have been acquired by the railroad companies and tracks laid along or in them, and a few are still extant, but are in a condition of desuetude. Where abandoned the charters have lapsed, as no provision had been made for reversion, and where changed into railroads probably enabling acts were passed so that the transfer of title might be legal.

STEAM RAILROADS.

As before noted the relation of steam roads with municipalities has not been generally close. All roads were built under special acts and later by general acts of the legislature, and all charters were perpetual. The control of the municipality was nominal, except in police jurisdiction, as to speed and protection of crossings. Public sentiment had but little influence in their management, as each road was presumably managed in the interests of the stockholders with the idea of obtaining the greatest revenue. Of later years the problem of grade crossings has brought the railroad company and the municipal authorities into closer association, in fact into practical .partnership, yet any suggestion of management in the number of trains, rates of fare, etc., has been rarely considered a matter of adjudication by the authorities, even though they have contributed a goodly amount of cash in their construction, and it is curious to notice that while the municipal authorities exercise careful and anxious supervision over the street railroad tracks they carefully ignore any matters relating to the steam roads. The United States government has its national committee and many of the states have their state commission, who are presumed to have general charge of matters relating to public welfare in railroad management, yet their existence is not pronounced.

There is one point that does affect every municipal community most profoundly, and that is the rate of fares charged by railroads, and its effect upon the growth and progress of sections through which the roads run. The railroad practice of today is the practice established in the early days of railroad development, there is little prospect of any change, it has never been changed and seemingly this point can be more aptly alluded to in discussing street railways.

The other point in which the municipality comes into touch with the railroad company, and on this point so much variety of practice exists that no rule can be laid down, is that it is essential in all manufacturing cities to have trackage facilities through and across public streets to connect the factories with the main line. These facilities are optional with a community to grant or not, and according to the emotions of the inhabitants of the city they are granted or rejected. Their construction in all its details is subject to municipal control and their permanency is dependent upon municipal will. These grants can not be called franchises, but are merely permits, but the companies collect revenues for their use and never pay any part to the city. In certain large cities lately the reconstruction of terminal facilities has been a matter of municipal supervision, and for the permanent privilege of such construction an annual rental is paid into the treasury of the city. In one case, strange to say, the city itself raised the money and built the works and propose to collect it from the company in the future.

GAS SUPPLIES.

The construction of gas plants is almost uniformly confined to private corporations, only one noted exception existing on the continent, of a city owning its gas plants, and the result has been anything but satisfactory. Gas, like water, was originaly introduced under special charters and later by general acts, and the service is usually under complete municipal control. The quality of the gas and the price are regulated, but there trip, most of the time were half filled, and the fare was ten cents. Without warning the company operating the road reduced the fare to five cents, and shortly afterward made application for a trolley franchise, unlimited as to time and with the customary clauses, keeping the fare at five cents without transfers. Public sentiment was so keen for the new improvement that the franchise was granted without demur and the result was that the trolley line ran cars every ten minutes, took twenty-five minutes for the trip and the cars were crowded to the doors, while the steam railroad was practically obliterated and everybody was happy. Three years afterward, with extraordinary expansion elsewhere a growing insistment of better terms by other municipalities, this very community could not find words too hard in condemning their own authorities for letting the trolley company get the best of the town as it did, and this growing sentiment in all communities in insisting on better terms from trolley companies has practically established now what might engineeringly be called an equilibrium and comparatively little is now being made in trolley extension.

This condition of affairs is detrimental to all communities, but, of course, is satisfactory to the companies owning the existing lines. The travel increases on their road, in many localities it is congested and further relief is not in sight, and, seemingly, if adequate provision is not made for future extension on satisfactory terms to both the public and the capitalist, travel will have to be forced back into the old channels; viz., the steam railroad and the highway.

One of the most curious facts relative to general travel is the rate of fare the public is willing to pay, and in considering this factor let us appreciate what is the practice to-day.

Ordinary steam railroad travel, two to three cents a mile average, thirty miles an hour.

Commuter steam railroad travel, one cent a mile average, thirty miles an hour.

Average electric travel, three-quarters to one cent a mile average, fifteen miles an hour.

Average electric travel in large cities, to one cent a mile, fifteen miles an hour.

Noting another factor in the case, that the American public does not consider any coin under the value of five cents as of paramount importance, witness the lack of appreciation of the three-cent fare in Detroit, and also note everywhere the general dissatisfaction with a six or seven-cent fare.

Now, what are the practical results of the above figures in their use by the public? Of course, limiting the investigation on steam railroads to a short haul, not including lengthy trips, in fact, presuming it all to be municipal or intramural travel, they may be summarized as follows:

Two to three cents a mile, light travel, short trains at infrequent intervals, with light loads.

One cent a mile, commutation. Every railroad with a cummuter patronage is congested and is forced to spend enormous sums to accommodate increasing travel.

Three-quarters of a cent a mile, trolley. Travel increasing by leaps and bounds, in many cases is congested.

The same statement applied to city travel.

It is, therefore, apparent that the general public would sooner pay a lower fare with a lower speed, the element of time not being so apparent, and the most extraordinary point in this whole matter is the fact that the steam railroad companies, having adopted the system of low rates for commuter travel, do not further extend the practice into their general travel.

A case in point may be cited where a steam railroad in 1855 established a rate of eighteen cents between two stations, the distance being five and a quarter miles. This rate is still in vogue, and the trolley line parallel with it charges six cents and extends a mile each way beyond the stations. The result is the receipts of the eighteen-cent fare are very meagre and the trolley cars are overcrowded. The difference in time is about ten minutes.

These citations raise the point at once whether, in addition to the control of street railways by the authorities, either local or state, some supervision should also be exercised over the steam railroads in the matter of fares and accommodations.

The old horse car lines were a law unto themselves until they wanted electricity, and the steam lines now have to get municipal consent in the reconstruction of the lines, and the same insistment can be made with them, if the municipal authorities will only take hold of the subject, but so far they have never done it.

Of course there is a great difference in principle between the two systems in the fact that the street railways occupy the public highway, but this is almost universally recognized by the companies paying a certain proportion of the receipts to the city and also paying for car licenses.

THE SUBWAY AND ELEVATED.

At this time allusion can be made to the purely municipal development of elevated roads and subways now operated by electricity. They are not very extensive and the franchise problem is not under discussion. The elevated railroads of New York, Brooklyn and Chicago were built under special acts, with unlimited franchises, and without much municipal control. It is of interest to remember that the Board of Health of the City of New York once attempted to take control, but the attempt was a failure.

The subways of New York and Boston are the two notable instances of municipal ownership, both built by the respective cities and leased to the traction companies under such conditions that the receipts pay for the interest on the bonds and for the principal for a series of years.

Electric light and power plants, now so extensive in the country, are subject to carrying conditions according to the ideas of different communities. There are two stages in these plants; first, the incipient stage, when the wires are carried on poles, and, secondly, when the wires are located underground. The introduction of electricity being of recent growth, the old-fashioned special charter does not appear and municipal authority over the private companies is complete. The contracts are made for public lighting for a long or short period, and then terminable, and there seems to be a variation from the practice in gas and water in that the franchise ceases at the same time; generally, however, there is a purchasing clause providing for a reversion to the town, and sometimes this is without compensation.

The doctrine of municipal ownership is being extensively practiced in electric street lighting, and the results are satisfactory; but the application as a rule is in smaller cities where supervision is easy. Considerable agitation, however, is being made in some of the larger cities and the results of their operations will be interesting.

Where the wires are put underground generally the company build and own the conduits. In some cities the city builds the conduits and the companies furnish and lay the wires. This point is interesting as maintaining the doctrine of public ownership in the highway.

Power plants are generally an adjunct to the lighting plant, use the same poles and belong to the same company. Independent plants, however, exist in some towns, and are completely subject to municipal dominion.

The municipal ownership of electric lighting plants practically prohibits this source of power, and in many towns this much desirable commodity is not obtainable from this source.

TELEPHONES.

The conditions of installation of telephones are practically the same as electric lighting. First, the poles, and then, as the community grows, subways are used. Telephone franchises are uncertain in their tenure, the telephone system of the country being in limited hands. The absolute tenure of the holdings is a legal problem known more particularly to the owners. Originally there was no limit to their permits. Of later years the public has become more solicitous on the question. The status of the telephone poles, scattered all over the country on the public highways, would be the subject of interesting investigation as to the authority for their erection beyond the consent of the land owner.

The tendency of the future, however, is to put the wires underground and the companies are systematically at work to that end.

These foregoing remarks include all that it is possible to say in the limited space available, and it may now be in order to summarize and offer a few sugestions for discussion.

Take the list as previously given and classifying them on the franchise basis we have as follows:

Unlimited Franchise: Turnpike roads, water supply, steam railroads, gas, canals generally, horse car roads, elevated roads, steam heating.

Limited Franchise: Electric light and electric power.

Both Limited and Unlimited: Electric railroads, telephone, electric light.

Municipal Ownership: Water, electric subway, gas, in one state.

The doctrine of limited franchise for street railways is now so nearly universally accepted that it bids fair soon to cease to be an issue. Financiers have perceived the trend of the times and are making no special effort to obtain limited franchises, on the other hand they are making no special effort to obtain any franchises that are particularly valuable, and as has been stated the public is suffering.

THE FUTURE.

The doctrine of municipal ownership is really the problem for considering future franchise granting, and in discussing this the first question is, is the public willing to assume the burden and responsibility of control? and secondly, is the public able to achieve as economical an administration as can be done under private enterprise? Municipal administration means political administration and political administration to-day is more one of sentiment and sympathy than that of business. The trend is for the better, but have we arrived yet at the condition where a street railroad system could be run by its political officials without the injection of so-called politics? It is done in Europe and can be done here, but the time is hardly ripe.

The enormously increasing functions of municipal administrations are in the line of pure socialism, probably the ideal condition, but a further assumption should be made with care. Taking the experience of municipal ownership to-day it is found that where a minimum of labor is required for administration, such as water supply and electric lighting, very sucessful results are obtained, but when the control of vast numbers of men is vested in a municipal board, however perfect its membership, the economical end is sometimes lost sight of and therefore it would not be a paying investment.

One happy solution of municipal ownership is the New York subway, owned by the city and operated by a private corporation. It is financially a success, and gives satisfaction. The proposition of the City of Chicago to purchase the surface lines and lease them is of undoubted merit and further relieves the franchise problem of its present doubtful status, viz: The usurpation of public rights in private ownership.

The doctrine of municipal ownership as practiced in Europe is a guide for future development on our continent, but the dissatisfaction that exists there over the high taxation incident to its assumption is probably greater than the complaints that are made on this side of the Atlantic, and, furthermore, the power of raising money and the price of it are of potent influence. A very large proportion of cities and towns today are bonded to the limit for absolutely necessary improvements, and to them municipal ownership is a hoped for condition not realizable at present.

The final conclusions of the committee are as follows, dividing the franchise question into two main heads:

First—Those that have control by purchase of their whole equipments.

Second—Those that have facilities in public highways.

Of the first little need be said at this time. Of the second, they are of opinion that all concessions to use the public highways, whether for water, gas, electric subways or car tracks, should be in the nature of permits, revocable at will, or definite periods of duration, and that no legislation should be permissible that in any shape usurped the complete ownership of the public in any public highway.

MR. OWEN: In Germany they are erecting complete trolley lines, and working them without the use of any tracks whatever. They simply have the overhead wires, and the cars travel on the highway. Of course you understand it would have to be a good highway. I understand that the difference in the cost of power is only about twenty per cent, in favor of the tracks.

With your permission, Mr. Barlow will now present to you his supplementary report.

MUNICIPAL FRANCHISES.

BY JOHN R. BARLOW, CITY SURVEYOR.

The subject of municipal franchises has of late years assumed a serious aspect, inasmuch as they are frequently granted without the consent of the civic authorities.

These franchises so given to private corporations by the legislature for rights over, along and under the streets of cities and towns are now so numerous that the streets are no longer under the control of the municipal authorities and steps must be taken in the near future to alter this state of affairs, and in the meantime every application should be contested until the rights of the city are recognized. The principal users of the streets are telephone, telegraph, gas, water electric street railway and light, heat and power companies.

Without doubt in the early days of most cities the civic authorities and citizens generally were only too pleased to grant permission to private corporations to lay pipes for the supply of water and gas, and also to erect poles for telegraph purposes, but the advent of the electric power has changed the aspect entirely and these companies desiring very extensive use of the streets have gone to the legislature and secured charters from that body which practically gives over the streets to them; it is true there is a proviso in these charters, that the city shall locate their poles, pipes or conduits, but if the civic authorities refuse to do so, then the company has the power to take their own location. This, as you may perceive, places a city in the position of seeming to acquiese in the franchise as granted, but at the same time gives them real power or control. At the present time civic authorities are awakening to the fact that the companies in some cities charge higher rates for their commodities than in others, or that the cost of production should demand, and they are further imbued with the idea that the civic authorities could supply the citizens with the same goods at a rate far below that which they have to pay at the present time, and after serious consideration of the matter are asking for better terms from the companies before definitely taking action to carry out their views.

At the present time companies that were originally in opposition to each other are rapidly becoming amalgamated into one corporation which, having things in their own hands, control prices.

In the City of Montreal there were at one time several companies which secured charters or franchises from the legislature to erect poles and lay conduits for light, power and telephone services, and while they were separate they each erected poles and laid conduits until the business part of the city's streets were completely occupied, but the laying of conduits has in no way lessened the number of poles in the streets, nor has the amalgamation of the light and power companies reduced the number of conduits or poles.

The civic authorities have under consideration the question of constructing a public conduit to take all the wires of the different companies before their systems are extended any further and at the same time remove all the poles which at present encumber the streets.

The water supply question has not as yet been any source of trouble in this section, 'but when the adjoining municipalities are annexed to the city the question will have to be faced, as all these municipalities are at present supplied by private corporations whose rates, if different from those of the city, *especially if greater,* will have to be regulated.

In conclusion the writer is of opinion that all water and light should be supplied by the civic authorities and that no franchises or charters should be granted to any company desiring the use of a city's streets unless the civic authorities agree thereto.

THE PRESIDENT: The report of the committee is now before the meeting for discussion.

Mr. Grosser: The subject being so important, and the meeting so small at this time that I would move that the discussion of this paper, or report, be held over till this evening or, if you like, till to-morrow, when all the members will be present, and a full discussion will be had on this very important subject.

The President: The difficulty in the way of your suggestion, Mr. Grosser, is that we have about twice as many papers as we have time for.

Of course I do not want to cut out any discussion, but it seems to me that it would be a bad precedent to allow the discussion of this report to go over when it will interfere with some other paper.

Mr. Owen: I do not know that it is a matter that the Society has to take any definite stand on. The only question is that it is a very live subject throughout the whole country, not only in the United States, but in Canada as well, and there is a great difference of opinion and knowledge on the question. As Mr. Grosser says, it is a very important question, and one that should have full discussion, if any action were to be taken.

The President: According to the action taken by this Society two years ago any person who is in any way prevented from discussing any of the papers as fully as he may like is invited, and even requested to send a written discussion of the paper to be published in the proceedings. Of course this is not as satisfactory as an oral discussion, but it sometimes happens that we have not the time at our disposal to discuss some of the papers as we would like. Then, on the other hand, there is this advantage in favor of it: a man may not have his ideas arranged in the way he wishes to present them, as soon as the paper is read, and if he takes the time to write out his remarks new ideas may suggest themselves to him.

There is another point that I wish to suggest to this meeting. The program calls for a three day meeting, but there is no reason why we should not make it three and a half, or even four days if we consider it advisable. There is nothing in the Constitution which prevents us from doing this. If we decide on this course it could be arranged that we postpone matters which seem of sufficient importance to be taken up at the additional sessions.

MR. SHERRERD: Mr. President, it occurred to me from the wording of the suggestion that it is more in the form of a recommendation than anything else, and that it is hardly wise for this Society to take any definite position on this broad subject at this Convention. I think Mr. Owen's paper shows a great deal of thought, and it has brought the subject to the attention of the members of the Society in a way which will make us think more seriously of it. I am speaking particularly for myself now.

It appears to me that it would be the proper thing to insert it in the proceedings as the conclusion of the report. It can be received and the Society in no way bound by it, or bound by any expression of our opinion, then we can act upon the whole thing at a future convention.

MR. OWEN: Our object was to put a conclusion before the meeting. Of course, the meeting does not have to take any action if they do not want to.

MR. GROSSER: This paper is a most excellent one, and gives the basis and development of the present demand for municipal ownership in such a manner that I, at least, feel myself unable to discuss it in a few minutes; least of all do I feel able, at the present time, to discuss the conclusions the committee has reached.

You all know that we, in Chicago, are specially interested in this question, and we are very strong against the granting of any franchise—and here I enter the discussion.

We believe in the great theory and principle that whatever an individual can do the people can do, and do far better than any individual, and if municipal ownership is good in one thing it is good in another thing. If we can operate municipal lighting successfully, as is done all over the country, and if we can operate successfully water plants, as is also done all over the country—we can operate street railway plants just as successfully.

One of the objections that Mr. Owen raises is that political interference and political influence will increase the cost of such operation. This may be true—it may increase the cost, but even supposing that it does, it would not cost the people a cent more than it costs them now. The difference would be that instead of a large profit being led into the pockets of individuals that profit would be expended in some other way.

As it stands to-day the people are being exploited by those public utility corporations, and we have been paying tribute to them ever since the nation has existed. The question is "shall that be continued in the future?"

In Chicago we have to deal with that problem. The people have declared repeatedly (and at the last spring election by a vote of 162,000 to 32,000) that no street railway franchise should be granted to any company.

We claim, and we prove by the other public utilities that the city owns, that we can, successfully, own and operate public utilities. The last legislature passed a law authorizing the City of Chicago to sell its surplus electricity to private consumers, and at the present time we own and operate a street lighting plant (and Chicago has the largest street lighting plant in the world). We operate 6,000 arc lamps at a cost of $55 per year per lamp. We are still running about 600 lights at a cost of $103 per light.

The authority received from the legislature will be voted upon by the people next November, and preparations have already been made to use the surplus electricity that we have, and, possibly ,to extend the plant.

The city electrician gave me his figures, and he says that we will be able to cut in half the charges of the present companies. He tells me that we will be able to produce electricity at the rate of 77-100 of a cent per kilowatt hour. Of course, the charge for wiring must be added to that, and the cost of this will depend on the distance of the location. The present charge of our companies is from 3 6/10 cents to 20 cents per kilowatt hour, according to the location and distance.

We have been successful in the municipal ownership and operation of lighting plants, and the municipal ownership and operation of water works and other utilities, and is there any reason why we should not enlarge the list?

We have had the experience of our great intercepting sewer system. In 1898 part of that great sewer system was thrown up by the contractors. The city thereupon undertook to finish the job, and it was finished, and the work done at a cost lower than the lowest contract. The city then wanted to complete the system on the north side, by direct labor, but was enjoined from doing so at the instance of one of the contractors. The matter was fought out to the Supreme Court, and a few days ago a decision was rendered which prevented the city from carrying out the work. The consequence was that we had to advertise for tenders again, and they were awarded at a cost of some $20,000 per unit higher than they ought to have been. The work has begun.

We say that the street railway service has been exploited by those private companies, and I tell you, gentlemen, right here, that the demand for municipal ownership was caused by one man. Somebody said to me that it was "those long-haired, daffy brained fellows who were crying for municipal ownership," but I tell you that is not the case. The famous (or infamous) Baron Yerkes has brought about this demand for municipal ownership. They watered their stock to such an extent that the people became dissatisfied, and when the franchises ran out they were not willing to renew them.

At the present day, under the decision of the Supreme Court of the United States, some 264 miles of track are available for immediate city use. The franchises have been declared run out on track covering that distance, and it is proposed now to take over that part, and to build a system comprising that 264 miles, and extend it later on. It has been proven that it can be operated successfully, and the only difficulties in the way are of a legal nature.

Of course, the owners of the stock in the old companies are doing everything in their power to impede the movement, but we do not know that they will be able to do very much against it.

I remember a paper read by Mr. Spence, the chairman of the council of Toronto. He said that they took over the plant in 1891 and began to operate, and that they paid the old company the full value of the real property and rolling stock, and that within the first three months they not only produced the interest on the invesment, but they had a net profit of $45,000. Then voices became loud, and people said that the whole thing was done only so that somebody might get a fat job. The result of this was that the system was changed—a private company took over the property and got a twenty year franchise under those conditions, they had to reimburse the city for every cent expended—they had to take over the property—they had to extend the lines, and they had to pay the city, in the first place a kind of a license amounting to $800 per month, and in addition to that, compensation ranging according to the amount of receipts from five to twenty per cent. Mr. Spence informs us that they have just reached the stage where the receipts of the company are so large that they have to pay the twenty per cent.

Toronto is a city of 200,000 inhabitants, and the street railway receipts for 1904 were $65,000 and they have a good service, but in spite of the good service, and in spite of the profit that there is in it, the general demand is that the city should take it over again when the charter expires in 1911. It is more than probable, I understand, that this will be done when the charter expires.

All this cry of "municipal graft" of which we hear so much is very much exaggerated. We never hear of private graft, because they know how to suppress it.

MR. OWEN: What about the Equitable?

MR. GROSSER: Well, that is another question. You very seldom hear of municipal graft, except possibly in Philadelphia. Still, we must be prepared to admit that there has been a great deal of graft in municipal affairs, and a great deal of corruption. But, let me ask you who causes the graft and the corruption in all cities if it is not the public utility corporations, who go to work in order to secure something for nothing and bribe the aldermen and the city officials wherever they can?

Now, even if political influence would have a great deal to do with municipal operation, I say that the corruption and evil of political influence could not be half so bad as the criminal influence exercised by those public utility corporations sometimes.

Another reason why we in Chicago are so absolutely in favor of municipal ownership is this: We believe that civil servants ought to be under a strict and honest civil service system, and I am proud to say that in Chicago we have a strict and honestly carried out civil service system. The mayor of the city cannot appoint his own brother to an office with the city—except as regards the department heads and the bridge tenders. We have 9,000 employes in the City of Chicago, and they are all under the civil service, and all the work that has been carried out by direct employment, and without the aid of a contractor, has been honestly, well and cheaply carried out. Mark me there. I say that it has been cheaply carried out.

Let us look at the street railway companies in Chicago to-day. In the year 1904 the two great companies received from passenger fares about fifteen million dollars. Their cost of operation and maintenance for the same period amounted to less than eight million dollars, so that they had a surplus over the cost of maintenance and operation of more than seven million dollars, which they used to pay taxes, interest—on what? On the bonds. And then they tried to pay dividends on the immense amount of water in their stock.

There will be no water in the stock if the city takes over the system, and, supposing that the cost of operation of those very roads was not seven and a half million, but ten and a half million dollars, who would profit by the difference between that and the fifteen million? Would the citizens lose anything by it? No. They will have to put their nickel up just the same. Well, who will profit by it? The public at large, because if there is a greater cost (and I am not prepared to say that there will or will not be), but if there is, how can it be explained? City officials of today do not steal money in this country—that is they do not steal directly. You or I very rarely hear of a city official who puts his hand in the public treasury and takes the money therefrom and puts it into his own pocket. What we do hear of is a case of corruption, or bribery, but not one of theft.

But, supposing they spend more of the profits, they may pay better wages, or they may have shorter hours for the men, and there is no doubt that that will be done. This in itself is a great advantage. Then in addition to this there is the benefit to the general public. Of course there are some who do not care for this. There are a few favored individuals who do not care for money—who have so much money that they do not know what to do with it, but those are not the ones I am speaking of. I am speaking of the ordinary citizen. If the system is taken over the result will be that the immense profits will be cut off a few gilded individuals who have already too much money, and they will have nothing left to do but to go over to London and build a "tuppenny tube," or move to New York and become bloated aristocrats.

I have given you those reasons why the people of Chicago are so strongly in favor of municipal ownership, and why the population is so firm in its demand and will succeed in obtaining what it wants. It will take a little time, and will have to be fought through the courts, but the thing will come and the result will be beneficial to the people.

Having had the experience of Chicago, I do not exactly coincide with Mr. Owen in the final conclusions that he has reached. If I understood him well, he said that a city should not operate anything, but should simply assert the ownership of the public highway. Well, you know in Chicago we have had that cry, "The streets belong to the people." That has been our common cry in five campaigns, and it carried every time. Of course the streets belong to the people, but that is not enough. The people should use the streets, and if they want any utility on the streets they should operate it themselves, and they can do it just as well as they operate the water plants and the lighting plants at the present time. The same thing applies to gas.

It was a sorry day fifty years ago when the legislators gave away valuable franchises to a few men, but if you look into the matter more closely, you will find out that those men paid for the privileges, and paid high for them, and that they are having to pay higher as time progresses. It is a fact that there is not a state legislature today in this country that is absolutely pure—that is above suspicion—at least, I do not know of one. There is not a legislature in any state today, whether it is the legislature of the state, or the House of Congress, or the United States Senate, if you please, where the great public utility corporations do not entertain very expensive lobbies, and for what purpose? If they have an honest demand, or if they have something to ask for that they deserve to get, why don't they ask for it honestly? Why don't they try to get it without attempting to bribe everybody? The mere fact that they entertain lobbies to prevent proper legislation shows logically that there must be some nigger in the wood pile.

I believe that the civic awakening that we have had throughout the length and breadth of this country during the past five or six years will do much to prepare the people to be ready for good government, if not at the present moment, at least in the near future—and when I say good government, I mean good government in municipalities as well as in states and in the nation.

Mr. Christy: It struck me that what Mr. Owens said was that in granting franchises we try to hedge them about with conditions, and when they go to court, the court takes a firm stand on the rights of the capital invested, and while you think that you have a condition which will make them do this, or make them do that, there is that right of capital which crops up and prevents the city from starting things which they think they have a right to start.

It seems to me that the only way is that the city should own the streets absolutely, and control them, especially as regards street railways.

Of course, there are many sides to that question, and I do not honestly believe that any city corporation can operate any public utility as cheaply and as effectively as a private corporation.

I believe that the advantages accruing from what little additional cost there may be is an advantage in favor of the people;

that is, the people have the matter in their own hands all the time, and as far as trying to grant franchises to corporations, and then make them stick to the conditions, why, when you go into court you will find that they get the best of you every time.

The idea that I got from the paper is the importance of the rights of capital, and the hard thing it is to tie the corporations down to just what the people want. The people's ideas of what they want are very changeable, and ten years from now they will be different from what they are today.

MR. GROSSER: Are you a city engineer?

MR. CHRISTY: No, sir, I am a lay man.

MR. GROSSER: What I wanted to ask is this: Is there any engineer ready to admit that in the employ of a private corporation he could carry out his work more effectively or more cheaply than he can in the employ of a city?

MR. OWEN: That is a close question.

MR. TILLSON: There was one thing that came to me as Mr. Owen was reading about the motor used in England, and it occurred to me that it might be of interest to the members.

Last spring I was talking with the mechanical engineer of a large trucking company in Brooklyn. This company delivers a large amount of coal and sugar each year, and this gentleman told me that they had been trying to use motors, and while the truck itself had worked well, the motors that they had obtained had been so poor and unsatisfactory that they had decided to undertake the manufacture of motor cars themselves, and at that time they were turning one out every three weeks, and the result was that with those cars they had been able to deliver coal three times as rapidly as they could with horses and trucks. I also understood from him that when they had equipped their coal business with a sufficient number of trucks to handle the entire coal trade they proposed manufacturing trucks for the sugar trade, where they have loads of eight or ten tons to carry sometimes.

There was one thing that surprised me still more than this, and that was in answer to a question as to how those motors operated in the winter. He said that last winter we had so much ice and snow after January that the streets paved with asphalt (even in the slippery weather) were much better adapted to the use of the motors than the streets paved with stone, and that when we did have in Brooklyn a sufficient number of asphalt paved streets to enable them to deliver their coal to all parts of the city on an asphalt pavement, then their motor service would be much more effective.

The sugar traffic which I allude to is so heavy that a few years ago we paved a street with the best granite blocks that come into the New York market, and in six months you could walk along that street and see a rut in the granite pavement. This was because there was a line of car tracks on the street, and the wheels of the wagons always went in nearly the same place. It was so serious that the sugar companies have had to send out men to separate this traffic and divide it up, but in a short time the ruts came in the same places again.

MR. OWEN: For fear of misunderstanding, and also somewhat in reply to my friend from Chicago, Mr. Grosser, I might say a word or two.

In the first place I wish to allude to one part of my paper, where I divide the classification of those franchises. Take the City of Chicago, which is a city of two million inhabitants, or take New York City, which is a city where this question can be agitated, because they can take care of the traffic within themselves.

In that portion of New Jersey where I stay we have a public service corporation which supplies about two-thirds of the community. Now, a municipal ownership in such a case as that would be an immense difficulty. Each municipality might decide to have its own service, owned by itself, and the result would be that you would have an incoherent mass without any development, and until a community is of sufficient size to have this development within itself I must differ with my friend Mr. Grosser.

Take, for instance, the street car line running from Detroit to Ann Arbor. A municipality could not operate a line like that.

MR. GROSSER: Well, the state could own and operate it.

Mr. Owen: The State of New Jersey would be constitutionally prohibited from operating such a line. There is no state debt, and never has been, and never will be.

I only offer this suggestion that Mr. Grosser's statement might be qualified to the extent that municipal ownership would be practicable for large municipalities, then I will agree with him entirely.

There is another point which seems to me to be important, and that is as to the financial capacity of the municipality to raise the money to build those plants. It is well known that New York has had to raise its taxation over thirty per cent, and get to its bonding limit in order to be able to construct the subway, and with all that the people are fairly well satisfied. This was an extraordinary way of extending public credit, but it is not popular, and I do not suppose Chicago would ever do such a thing.

Mr. Grosser: Will you agree with me that aside from financial and legal questions, municipal ownership or public ownership is the proper thing in theory and principle?

Mr. Owen: We say so in our paper.

Mr. Reimer: My friend, Mr. Owen, has anticipated me a little, but let me put this before you.

Given a city of 275,000 inhabitants, out of which a trolley line runs for two miles, into another corporation with 25,000 inhabitants. It then runs for a mile and three-fifths into another corporation having about 28,000 people, and then about a mile into another with about 12,000 people. What would be the condition of a municipal owned trolley under those circumstances?

Mr. Hutcheon: The water works in our town were built by the city some twenty-five years ago, and have always been operated by the corporation. The gas and electric plants were taken over about a year ago by the city at a cost of $160,000, and have been operated for that year under the old management. After paying all expenses last year the committee were able to turn over something like $15,000 of profit to the city treasurer.

Under the old management the street railway was losing money —they lost a few thousand dollars every year (we have only five miles of track). Well, it was taken over by the city at a cost of $80,000, nearly, about two years ago. The first year after it was taken over it lost something like two thousand dollars. The commissioners have extended the line, and acquired a park, and increased the traffic and the result is that this year the street railway system will pay expenses, and we expect that within a few years it will be a money maker. As I said, we have but five miles of track, in a city of 12,000 inhabitants.

Mr. Grosser: And after two years you find that the street railway system pays expenses?

Mr. Hutcheon: This year it will pay expenses.

Mr. Reimer: What is the area of your town?

Mr. Hutcheon: It is a scattered place, about four square miles. We extend about a mile outside on one side of the city limits, and about half a mile on the other side.

Mr. Owen: Do you operate outside of the city limits?

Mr. Hutcheon: Yes, sir.

Mr. Owen: Under what authority?

Mr. Hutcheon: That I cannot tell you at the moment. The charter was acquired by the men who built the road, and the city in taking over the system bought the stock, and assumed the bonded debt. Of course I only cite this as a case where municipal ownership has been successful.

Mr. Phillips: Does Mr. Grosser think it possible or practicable to operate a trolley road system economically and honestly without civil service rules?

Mr. Grosser: At first glance I might be inclined to answer no. I think I pointed out in my remarks that even without civil service the disadvantages cannot possibly be as great as under corporate control, because to-day a corporation exercises a far greater influence in politics, in any large city, at least, than any city political machine can possibly exercise. We have seen this in almost all large cities. So that, while for efficient and economical administration we demand civil service, I do not believe that even without it the disadvantages can be as great as under private ownership.

Mr. Phillips: I have seen it in the public press a short time ago that Mayor Dunne of Chicago had given expression to the declaration that it would be impossible, and that it was not his plan to extend the civil service rules to the conductors and trolley operators and motormen on the trolley cars—that they were not to be put on the qualified list.

Mr. Grosser: I think I can unqualifiedly state that Mayor Dunne never made such a declaration, and if any paper said so they stated something that was never said by Mayor Dunne.

I happen to be in a position to know exactly what Mayor Dunne says, or does not say, and I tell you that he never said that.

Mr. Phillips: If that was the case it would place a large number of employes in a class where they might be operated upon by politicians, and become a source of corruption, but, of course, Mr. Grosser says that the mayor does not hold that view at all, so there is no danger.

Mr. Grosser: Even the street cleaners in Chicago are under the civil service rules. The only exception in all the employes are the members of the legal department, the police judges and the clerks of the police courts, the heads of the departments and the bridge tenders.

In the "heads of the departments" must be understood the heads of the entire department, this does not include the city engineer. He is under civil service. The commissioner of public works is not. The city comptroller is not, but the city auditor is. The fire marshal is not, but the deputy fire marshal is, and every member of the fire department is. The chief of police is not, but his assistant is, and so are all the members of the force.

The effect is that actually only the members of the cabinet—the members of the law department, the police judges and clerks and the heads of the departments are not under civil service—to this list must be added (as a relic of the old squad system) the bridge tenders.

There being no further business before the meeting, the first session was thereafter adjourned.

SECOND SESSION.

The second session of the meeting was called to order by the President at 8:10 P. M., Tuesday, September 5th. He said:

The first order of business before us this evening is the paper on "Taxation and Assessment," which is the report of the committee on this subject. Mr. N. P. Lewis of New York is chairman of this committee. Mr. Lewis has not found it possible to be here, but I have his paper, and with the consent of the meeting will read it myself.

THE THEORY AND PRACTICE OF ASSESSMENTS FOR LOCAL IMPROVEMENTS.

BY NELSON P. LEWIS, CHIEF ENGINEER BOARD OF ESTIMATE AND APPORTIONMENT, NEW YORK CITY.

The subject of taxation and assessment has been so thoroughly covered by papers and discussions at previous meetings of the American Society of Municipal Improvements that it would seem as though little were left to be said. The chairman of the committee a year ago suggested that it might be advisable to combine this committee with that on city government and legislation, but the separate committee having been continued. I will present for your consideration some comments upon the theory and practice of assessments for local improvements. These comments will be confined almost exclusively to the practice in New York State, and particularly in New York City, which may be considered typical, notwithstanding that its enormous size and the varying conditions existing in its different boroughs naturally places New York City in a class by itself.

Improvements, the cost of which are usually assessed for benefit, are the opening of streets, the building of sewers, the grading and paving of streets, and the flagging of sidewalks. In some cities, street sprinkling is also assessed directly upon the abutting property, but this cannot be considered a local improvement. A recent statute affecting New York City provides that the planting of trees shall be treated as a local improvement and assessed upon the property benefited. The underlying principle governing assesments is the same in all cities in the United States, namely, that where there is a special benefit there should be a special tax, and that the functions of the modern city are so varied and the sums required for general administration are so large, that it would be impossible to add to the tax levy the cost of making local improvements. While the laws in force in the different cities and states recognize this principle, the details vary greatly. The manner of authorizing assessable improvements in New York City is exceptionally simple. The city is divided into twenty-five local improvement districts, and the members of the board of aldermen resident in each of these districts constitute what is known as the district local board. The borough president is a member and the presiding officer of every local board in his borough. Petitions for assessable improvements are addressed to the borough president, who gives public notice of the fact and that a hearing will be given before the local board, a meeting of which is called to consider the petition. If the local board acts favorably, a certified copy of this resolution, approved by the borough president, is forwarded to the board of estimate and apportionment, and upon the approval of the latter board, the improvement is duly authorized and the borough president has power to contract for and carry out any physical improvement, while in the case of acquiring title to streets, the corporation counsel is directed to apply to the courts for the appointment of commissioners of condemnation, estimate and assessment. The board of estimate and apportionment can initiate proceedings for an improvement, but it has been held that the right to levy an assessment is doubtful, unless the proceeding shall have originated in a local board. Petitions for improvements need not be signed by any special number of property owners, nor is it essential that the petitioners shall be even abutting owners. It has also been held that the recommendation of a responsible head of a department or bureau that a certain improvement, such as the building of a sewer, or sewer basins, is necessary, is equivalent to a petition, and the board may act upon such recommendation and institute proceedings for the improvement.

The most complex problems which arise are in connection with the opening of streets, especially in New York City, and many instances can be given of abuses and absurdities in such proceedings. As street openings involve the taking of private property, they are necessarily court proceedings, and upon the application of the city's legal officer, three commissioners are appointed to determine the awards to be paid for property taken, to fix the district of assessment, and the amount to be paid by each parcel deemed to be benefited. These commissioners, when they have been appointed and have qualified, are practically a law unto themselves. They are the sole judges of the district over which the assessment is to be spread, and of the amount of damage and benefit. They are allowed a fee of $10 for each meeting of the commission, and there have been cases in which the same person has served at the same time on a number of commissions. Such appointments are profitable when one can report at two, three or more different meetings, be recorded as present, find that nothing is being done, and go about his ordinary business. The owners of property to be taken are expected to prove their titles before this commission, and they can and usually do produce expert witnesses as to values. The city also employes its own experts to testify as to values. The awards paid frequently bear little relation to the assessed value or to actual values as indicated by the city's appraisers. In the case of a park recently acquired in the City of New York, the city's appraisers testified to a total value of the property taken of about $888,000. The commissioners awarded $1,999,000. These awards were subsequently reduced some $200,000, and the commissioners, on account of their valuable service in reducing these awards, applied for and received from the court an extra allowance of about $1,500 each. These figures are given from memory, but they are substantially correct. It may be said, however, that the property taken for this park is in a section where values are somewhat unstable and are naturally affected by the great bridges now being built across the East river. In the older portions of the city there is a more uniform relation between the assessed value of property taken for such purposes and the cost to the city by its acquisition. In a number of cases it was found that the ultimate cost to the city was from 2.1 to 2.5 times the asessed value of the property at the time that the condemnation proceedings were instituted. At that time real estate was assessed at about sixty per cent of its actual value; it is now assessed as nearly as possible at its full value, so that an increase of fifty per cent over the assessed value would be a fair figure for the cost of acquisition. Great abuses have sprung up where buildings are taken in street opening proceedings. There have been many cases where buildings of an inferior character have been deliberately placed within the limits of a street which it was known would soon be opened. "Expert" appraisers testified to the commission as to the great value of these buildings. After their purchase by the city they are sold at public auction and are usually bid in by the original owners for a nominal consideration, after which they are placed on rollers and moved back off the line of the street, little the worse for their journey. The more enterprising owners of such buildings move them, not to a site where they can remain permanently, but to a position within the lines of some intersecting street, where within a few years, or possibly months, they will be again condemned, again bought at their full value, as proven by "expert" appraisers, and again moved. There is one case in which the same frame building is said to have been bought three times for the opening of three different streets, bought in at a nominal sum three times by the same owner, and finally moved to a permanent site. It has been frequently urged that a street opening commission should make alternative awards for buildings taken, one award for demolition, which would be actual value, and another award for removal, which would represent the cost of such removal and the consequent deterioration in the value of the structure. Strange to say, these suggestions have never been acted upon.

The commissioners in street opening proceedings are also given specific authority to make allowance for intended regulating and grading of the street to be opened, where there are buildings which would be materially damaged by the physical change of the surface of the street on which they abut. This is another source of abuse, and it not infrequently happens that the damage allowed for is never imposed, but that before the improvement of the street the grade is changed to minimize or avoid entirely a damage which would follow the filling or the cutting down of the natural surface. It is entirely unnecessary that the street opening commissions should make such allowance, as the board of assesors for local improvements other than street openings are specifically given the power to make awards for such changes of grade and to include the amounts so awarded in the assessment for the improvement.

In view of the enormous expense of street openings under such a policy, it is not unnatural that the owners of property abutting on streets which have been used to any extent endeavor to avoid opening proceedings by claiming a dedication of their street as a common-law highway. This is one of the most difficult problems to deal with. Evidences of dedication are frequently very incomplete; affidavits showing public useage are readily secured, but as a rule they are entirely untrustworthy, and where sewers have been built or surface improvements made on streets claimed to have been dedicated, the collection of assessments has been resisted, and in several instances actions have been brought against the city for damage through trespass.

It was recently proposed to correct the abuses which have grown up in connection with street openings by the creation of a permanent commission of awards, this commission to consist of men carefully selected by the courts, in conjunction with one or more of the state and city officers, to hold office for long terms and to receive ample salaries. It was thought that the various condemnation proceedings begun by the city would keep a commission of a dozen or more men constantly employed, that there would be some uniformity of practice, and that the cost of these proceedings would be enormously reduced, but legislation providing for this change was not secured.

It has already been stated that upon the recommendation of a local board the board of estimate and apportionment has full power to authorize any assessable improvement. The board is also given the express power to determine what portion, if any, of the cost of such improvements shall be borne by the city at large. This you will say is a dangerous power to give to any body of men, but up to the present time it has been used wisely and conservatively. In the case of street openings, the board has determined that every street sixty feet or less in width is almost wholly for local purposes, and that the entire expense of acquiring it should be paid by assessment. Where streets are more than sixty feet in width, the board assumes for the city at large one-third the cost of acquiring that portion over sixty feet in width, so that for a street of eighty feet the city would pay 8 1-3 per cent of the entire cost, while for a street 100 feet in width it would pay 13 1-3 per cent. Where an existing street is to be widened, the city at large will assume one-half the cost of acquiring so much of the property as is in excess of that needed for a street of sixty feet. In case a street of fifty feet is to be widened to eighty feet, the first ten feet to be acquired is at the expense of the property owners; of the remaining twenty feet to give the eighty-foot width the city will pay one-half, or one-third of the total cost of the proceeding. A rather curious limitation which has been placed upon the board of estimate and apportionment is that, having initiated an opening proceeding and determined what proportion of the cost shall be assessed, it cannot reconsider its own determination. Previous to the amendment of the Greater New York charter, which took effect on January 1, 1902, theboard of public improvements, which then performed the functions since transferred to the board of estimate and apportionment, had the power to amend its action in this respect, and it was the uniform practice to initiate proceedings with the express provision that the entire cost and expense should be borne by the property benefited. Before the confirmation of the awards and asessments, petitions would be submitted to this board for relief, and if the petitions were sufficiently strong and persistent, such relief would be given, its measure being determined by the force of the petition or protest. A few days before the board of public improvements went out of existence it reconsidered a large number of its previous determinations, and imposed upon the city at large from one-fourth to all of the expense of opening a number of streets. It was the danger of such action that doubtless prompted the provision in the amended charter, prohibiting the board of estimate and apportionment from reconsidering its determinations. An effort was made by the last named board to reconsider the action of the board of public improvements in the closing days of its life, but it was held by the courts that the limitations of the board as to its own action applied also to the board of public improvements. There were some few cases where relief could properly be given which were not acted upon by the board of public improvements, and the legislature of 1905 authorized the board of estimate and apportionment to reconsider the action of the board of public improvements in all cases where that board had determined that the entire expense should be assessed upon the property benefited, but it was careful not to give the right to reopen the cases where the old board had been over generous.

The city charter prohibits the levying of assessment for any single improvement which shall be more than one-half the "fair value" of the property assessed. This "fair value" is usually construed to mean its assessed value, and if the assessment for any parcel amounts to more than one-half its assessed value the city pays the difference. If the "fair," or actual value were used, there would be very few cases where the property could not stand the assessment, but the use of the assessed value frequently results in a great injustice, as where assessments are low, the owners of the property will sometimes deliberately defer private improvements of any kind until all physical street improvements shall have been made and the city shall have come to their rescue by paying a part of their assessment, while those who have improved their property and added to taxable values are obliged to pay their full share. In some cities it has been the practice to assess not only original pavements, but all subsequent renewals of pavements. In the City of Brooklyn, before its consolidation with New York, it was the practice to assess one-half the cost of repaving, the city at large paying the other half. Since consolidation, however, the New York practice has prevailed, and it is now impossible to assess any of the cost of repaving unless a petition for such repaving shall have been presented, signed by the owners of a majority of the frontage on the street, which petition shall express their willingness to be assessed. It is unnecessary to say that while there is a chance of having their street repaved by the city at large, there is little probability of securing such a petition. It has usually been the practice in New York City to assess the cost of rebuilding or enlarging sewers, when such improvements became necessary, and in the borough of Manhattan the property values are so great that such assessments are not noticed and have been the cause of no complaint. In some of the other boroughs, however, extensive sewer construction has lately become necessary, as well as the building of large relief sewers to avoid flooding. This flooding has become more frequent and more disastrous as smooth pavements have been laid, resulting in a more rapid run-off of surface water, and the city has lately committed itself to expenditures of millions of dollars for the enlargement of sewers and the building of relief sewers in districts where the property is amply able to pay the cost of such improvements.

There is a certain class of street improvements which, while they will have a decidedly beneficial effect upon property in the immediate neighborhood, are of such great importance to the entire municipality that they frequently are, and properly so, carried out at the expense of the city at large. I refer to the laying out and improvement of new streets designed to give access to important structures, such as great bridges, or to furnish more ready connections between commercial, manufacturing or transportation centers. Instances of this kind are the approaches to the great bridges recently built or under construction across the East river, in New York City, such new streets being necessary for collection and distribution of the immense vehicular and surface railroad traffic which these bridges will accomodate. The laying out of such streets and their location must be determined by some central authority, and cannot be left to the initiative of individauls whose property would be affected, or even of local boards. It is therefore difficult to secure petitions and resolutions of local boards, in the absence of which, as already stated, assessments for benefit cannot be levied. That there is great benefit to the property which will front on these new thoroughfares cannot be questioned, and in equity the property so benefited should bear at least a portion of the expense. If, then, the city at large finds it necessary to assume the entire burden of laying out, opening and improving such thoroughfares, the city at large should reap the benefit. This could be readily done were the city able to condemn not only the area needed for the proposed new street, but the abutting and contiguous property, the value of which will be greatly enhanced by the improvement. Our present laws do not permit, and it is doubtful if public sentiment at the present time would approve of the city's embarking in a real estate enterprise. This practice, however, is the rule, rather than the exception, in European cities.

In the City of London a great improvement of this kind is now under way which involves the widening of the Strand, between Wellington street and the Church of St. Clement Danes, a distance of about 1,250 feet, the laying out of a new crescent-shaped street 100 feet in width connecting with the Strand at these two points, and of a new avenue 110 feet wide from the middle of this crescent to High Holborn, at Southampton road. The length of the crescent is about 1,400 feet, and that of the new avenue connecting it with High Holborn is about 1,600 feet. The city is said to have already acquired the greater part of the contiguous property, which it purposes to hold, and it is expected that the sale of long rentals for its occupation will make the investment a very profitable one, although the cost is estimated at about $25,000,000. A further advantage is that the city can control absolutely the architectural development of the street and the purposes for which the property is to be used, and the result in this case will doubtless be the creation of one of the finest thoroughfares in the world. Improvements of this class, which, though most desirable, are often considered prohibitive in cost, might thus be made profitable ventures, while the theory of a special tax for a special benefit would not be violated. The city in this case pays a special tax; would it not be fair that the city should also reap the special benefit, rather than create at public expense a new thoroughfare which would add enormously to the value of the property of those which are fortunate enough to front thereon? I cannot but believe that this practice will ultimately be adopted in American cities.

It has often been urged that there should be uniformity of practice in the different states and cities in the levying of assessments for local improvements. Such uniformity might be a fortunate thing for the students of municipal government, but the conditions in the different states, the variation of the constitutional limit of the bonded indebtedness of cities, etc., varies so greatly that uniformity of practice seems to be impracticable. It might be possible to secure uniformity in the cities of the same class in each state, or possibly for all the cities of one state, but further than this it will doubtless be impossible to go. Conditions in the different boroughs of New York City vary so greatly that it might be wise to adopt for those of a suburban character a different method from that followed in the older sections where the property values are very much greater.

THE PRESIDENT: The next item on our program is the report of the Committee on City Government and Legislation. Mr. William S. Crandall of New York City is chairman of this committee, and it is now in order for us to hear the report he has to make.

MR. CRANDALL: As is sometimes the case, there is no report to be made this year on the subject allotted to me, City Government and Legislation; there are rather two papers, the first by Mr. Thomas J. Neville, Commissioner of Public Works, Rochester, N. Y., who is present and will read his paper covering the White Charter, covering, I think, five cities in the State of New York. I am pleased to introduce Mr. Neville to you.

MR. NEVILLE: Mr. President and Gentlemen: This topic is not one that I am particularly qualified to deal with or discuss, as it deals largely with the charter which we have in four cities in the State of New York, namely, Rochester, Syracuse, Albany and Troy. My paper simply contains a running review of the charter and the causes which led to its introduction. It also touches somewhat upon the law under which those cities are now exercising municipal authority.

Without further introduction I will proceed with the reading of the paper.

LEGISLATIVE FUNCTIONS UNDER THE WHITE CHARTER AND THE PRACTICAL EFFECTS OF THE LATTER UPON MUNICIPAL GOVERNMENT.

BY THOMAS NEVILLE, COMMISSIONER OF PUBLIC WORKS, ROCHESTER, N. Y.

"Legislative functions under the White Charter and the practical effects of the latter upon municipal government," is the subject submitted to me for discussion before this Convention.

I may consider, firstly, the legislative functions of the White Charter, by reciting briefly the causes that gave rise to the charter and its central idea for the government of certain cities.

By the Constitution of the State of New York, the cities are divided into three classes, acording to population. Rochester, Syracuse, Albany and Troy are in the second class and are governed by what is known as the "White" Charter, taking its name from Senator Horace White of Syracuse, who introduced the act in 1898, which went into effect on the first of January, 1900.

It was generally believed that this charter repealed all acts or laws passed for the government of these cities, but the fact is that it only repealed those laws inconsistent with those embraced in the bill and left all preceding laws that did not conflict with the provisions of the White Charter in full force and effect. So it may be understood, that the cities named are now governed by what is known as the White Charter *and all the old charter provisions that were not repealed.*

I may state that Rochester has had the experience of many other cities in the matter of its charter construction. From the simple village creation, additions were made from year to year, until the structure became a composite of additions, amendments and alterations, and was referred to by press and people as a mass of contradictions and inconsistencies; and tinkering the charter to suit some individual or other local purpose was made the duty of the legislature from year to year.

In 1880 the legislature passed an act authorizing the amending and consolidating of the several acts relating to the charter of the City of Rochester. Special acts have been passed for various purposes, such as parks, trunk sewer systems, police and fire departments, protection of water supply and other special matters of this character. In addition to the White Charter and the remnants of the old charter, general laws have been passed which effect the government of the city and which have to be observed and enforced.

The constitutional convention of 1894 classified the cities of the state, and in 1895 the legislature passed an act authorizing the governor to appoint a commission to prepare and report a law for the government of cities of the second class. Under this act Hon. James G. Cutler, the present mayor of the City of Rochester, was one of the appointees. Associated with him were Alden Chester of Albany, Michael E. Driscoll of Syracuse, David M. Green, Troy; ex-chief judge of the Court of Appeals, Robert Earl of Herkimer, as commissioner at large. Mr. Chester having been subsequently elected justice of the Supreme Court, his place was filled by Arthur L. Andrews of Albany. This commission reported to the legislature in 1896. Upon the report of this commission, the legislature passed an act, in 1898, upon which was based the charter to which Senator White of Syracuse gave his name.

The formative idea of the White Charter was to centralize authority in the mayor, giving him absolute control over the executive branch of the municipal departments with power to hold them to responsibility for the faithful performance of their duties and power to remove, at pleasure, any appointee who failed to perform his duties to the satisfaction of the mayor and according to his judgment and direction.

It took away from the common council, or board of aldermen, all powers except those of a legislative character, and made the mayor controlling power in the executive branch of municipal government.

It created two boards, one designated as the board of contract and supply and the other as the board of estimate and apportionment. The former board is made up of the mayor, the corporation counsel, commissioner of public works, city engineer and the city comptroller. The board of estimate and apportionment is composed of the mayor, the president of the common council, the city comptroller, the corporation counsel and the city engineer.

The functions of the board of contract and supply are the awarding of all contracts for public improvements, public buildings, etc. The board of estimate and apportionment, as its title implies, makes up all estimates for the fiscal year, for the care and maintenance of the several branches of the city government; and these proportions, as determined by this board, are subject to the approval of the common council, and the amounts cannot be increased, but may be decreased by that body.

A detailed statement of the duties of the heads of the several departments I deem unnecessary in this paper and therefore pass that by, but I will be pleased to answer any inquiries by the members of this Convention which may be made concerning the duties of such officers.

The second clause of the subject matter of this paper, namely, "The practical effects of the latter upon municipal government," offers opportunity for the expression of differences of opinion as to what the practical effects have been in each of the cities where it is in force.

The general opinion of officials having to do with the practical administration of city government is, I believe, that a uniform charter for any group of cities is almost impracticable, excepting in what are the fundamental principles of government in every state where law and order is established.

When it comes to details of municipal administration, it is often found that theory does not always harmonize with practice and many of the provisions of laws designed to attain a better system of government are found to be difficult of enforcement and are often slighted, ignored or violated. And these evasions of the law are often justified, on the ground of expediency, or as the only manner of administering city affairs through business-like methods. So the city official has often the difficult problem of determining, in order to do his work expeditiously and effectually, to follow the strict construction of the statute, or by placing a reasonable interpretation upon its meaning, incur the consequent danger of having his acts brought under the suspicion of corrupt intention.

The administrative functions of all cities are in the main alike, but what may be an economical mode of procedure in one city may be in another expensive or impracticable, because methods and details of government vary acording to local conditions. In a word, you cannot clothe several towns or cities in the same coat, for while it may fit in some respects, the garment will be a misfit in others. It may be too long or too short, too close fitting or too loose.

There is no doubt that the gentleman who laid the foundation for the White Charter gleaned from the study of the code of laws existing throughout the country and the results of the operation of such laws, the best methods of municipal government obtainable and condensed and formulated them into the uniform charter now in force in the second class cities in New York State. They, no doubt, did not believe that it was a perfect code of government, but intended to do away with the incoherent and disjointed procedures of the past, which mixed legislative, executive and judicial power in such a way as to divide responsibility, rendering it almost impossible to fix liability for irregularities or corrupt action. In that respect the White Charter has been a success and its operation effectual.

The twenty aldermen composing the legislative branch of the city government and representing the several wards or districts of the City of Rochester are in close touch with their constituents and know the needs and wants of their people and are enabled to intelligently legislate in their interests, while the executive branch of the city government, carrying out the will of the citizens as expresed through their laws and ordinances, and being responsible for the care and maintenance of the city's property and the expenditure of the moneys raised by taxation, is centered in the head of the government, the mayor, who is directly responsible to the people for the conduct of the prudential affairs of the city and for the proper management of the several departments in the administration of the city government.

Touching upon the general statement that the instrument in question is not perfect, I took occasion to secure expressions of opinion from the cities of Syracuse, Albany and Troy, from which I abstract such matter as will bear upon this subject.

An official of Syracuse makes the following reply: "It has always seemed to me that the idea of this charter was to concentrate, as far as possible, the responsibility and power in the mayor. The difficulty with the charter, in my judgment, has been in the application of this idea to the divergent needs of the different municipalities. Our city is, of course, also governed by its old charter, which is known as the revised charter of the city, and since the White Charter went into effect there have been a great many amendments made to our revised charter, and especially during the last session of the legislature, so that it would be very difficult to say at the present time, without much study and investigation, to just what extent our city is now governed by the provisions of the White Charter."

Albany says.: "We did not introduce any amendments last winter. The charter operates admirably in our city and without friction."

Troy replies: "I am pleased to inform you that no amendments have been made in our instance. We have, however, in public work projects inaugurated under special laws in force at the time of the uniform charter's first application, found it necessary last year and this year to seek and secure special legislation upon those subjects to provide the means of carrying out the projects. We find here that the new charter works well, allowing for the infirmities of the scheme which can be remedied from time to time as they present the necessity for such remedy."

In the City of Rochester the following amendments have been made:

In the year 1900 three acts were passed amending the charter. Eight different sections were amended.

In 1901, five amendments.

In 1902, eight amendments.

In 1903, eleven amendments.

In 1904, seven amendments.

In 1905 there were six amendments, and twenty-seven sections of the old charter of the city were amended.

In the year 1905 most of the four cities contained in the second class obtained the passage of special acts relating to each city, thus removing them, so far as the matters contained in said acts are concerned, from under the provisions of the White Charter.

Despite all the amendments to the White Charter and to the charter to each of the cities of the second class, the form of government prescribed by the provisions of the White Charter still remains in force, amendments and alterations relating only to details and matters of procedure.

MR. NEVILLE: The summary of the matter is this: I do not think it is within the power of any city to lay down laws that will answer for other cities. My personal belief is that there is nothing that can be done to govern a city except a charter that will provide for the conditions and requirements of that city.

Like a general law, a charter may be framed that will apply to Montreal, Toronto, New York and Chicago, but when it comes down to a matter of strict administration I do not believe that there is any set of men who can frame a charter which will answer all the purposes of each and every one of the cities, especially if those men are not in touch with all the conditions and requirements of each of the cities. We have in the City of Rochester a great many amendments which have been introduced, and which are now in force since this White Charter was adopted.

THE PRESIDENT: This paper is now open for discussion, and, as I think, Mr. Neville stated he would be glad to answer any questions in regard to the details of the charter itself, or its workings. Are there any remarks on this paper?

MR. BROWN: I would like to emphasize the statement that a single charter can hardly be formed which will successfully govern a number of cities, still I think it might be modified a little, and I say this from the experience we have had in our state. The charter described by Mr. Neville was evidently founded on the same idea as the Indianapolis charter, which has been in successful operation thirteen years. Of course, it has had some amendments, but they have been only matters of detail.

From time to time during the thirteen years some of the smaller cities in the state have adopted charters based upon the Indianapolis charter, and modified to suit their particular conditions. Those cities were classified by population, and when a city passed from one class to another at the census it had to change its form of government in order to suit the constitutional provisions. The result of this was not altogether satisfactory, and last year a codification commission which had been appointed by the legislature prepared a charter which would apply to all the cities of the state, the idea being that the different cities could modify it to suit the conditions of their class. It was divided into five classes. The first class was for cities of over 100,000 inhabitants, and the fifth class was for cities under 5,000. You will see from this that they tried to cover a great number of classes of cities in one charter.

The practical result of the charter supplied is that we have only the one charter—only one standard to judge by—and the Indianapolis charter, if left as it was, is practically as satisfactory as it ever was.

The charters of the cities of the second class were changed so slightly under the new charter that they are also satisfactory. The third class cities are somewhat more materially changed, but when we get down to the fourth class there is some trouble, and when we go as far as the fifth class no one knows what acts govern them, and it is extremely difficult to proceed with anything that the city is trying to do.

In other words, the state tried to do too big a job all at once. So far as the larger cities are concerned, the results are entirely satisfactory, but the smaller cities (as Mr. Neville has suggested) cannot be governed by the same form of government.

THE PRESIDENT: Are there any other remarks on this subject?

MR. CRANDALL: Acting on the suggestion of several people interested in the general discussion of this question, I secured a paper from Dr. Milo R. Maltbie, who is the secretary of the Municipal Art Commission of New York City, and who is very familiar with the charter governing Greater New York. This paper is entitled "The Legislative Functions of Greater New York." Inasmuch as Mr. Maltbie is not with us, I would ask that the paper be read simply by title, and that it be printed in the proceedings and come up for consideration at a later date.

Mr. Maltbie's paper is as follows:

THE LEGISLATIVE FUNCTIONS OF GREATER NEW YORK.

BY MILO R. MALTBIE.

(Secretary Municipal Art Commission of New York City, and Consulting Editor of the *Municipal News*, 309 Broadway, New York.)

With very few exceptions every modern city has a legislative body chosen to represent the people and to determine the general character and policy of its municipal administration, but the functions of these legislative bodies vary greatly, and the discussion of their character in New York City resembles very closely a treatise upon snakes in Ireland.

In the early part of the last century the New York board of aldermen had large powers, both of legislation and of administration. But rightly or wrongly, it came to be blamed for nearly all of our municipal shortcomings, and year by year it was short of its prerogatives. Certain ones were transferred to the mayor, others to the administrative departments, others to the newly created board of estimate and apportionment, and still others, constituting by far the larger portion, were taken over by the state legislature itself. The most recent move in this direction was the law passed at Albany last winter transferring the power to grant franchises from the board of aldermen to the board of estimate.

The city charter contains many sections enumerating the powers of the board of aldermen, and one might infer therefrom that it is an important body. It may make, amend and repeal ordinances regarding a long list of subjects. It may order the acquisition of water works, markets, parks, bridges, tunnels, wharves, public buildings, schools, etc. It may regulate a long list of trades. It may fix the salaries of city officers and perform many other functions which at first glance appear to be very important.

The restrictions and limitations upon these powers are so great, however, that little discretion is left. In the first place the board of aldermen has nothing whatever to do with the preparation of the budget. This function belongs exclusively to the board of estimate and apportionment, which considers the wants and needs of the various departments and determines the amounts to be appropriated for the coming year. The budget is then forwarded to the board of aldermen, which is allowed only twenty days to consider it and may only decrease certain items. Even then its action is reviewable by the mayor, and his veto may be overridden only by a three-fourths vote. Further, all bond issues must originate in the board of estimate, and if a majority of all members of the board of aldermen shall not vote againt a proposal issue within six weeks, it shall take effect without their approval. Even changes in salaries must first be passed by the board of estimate.

The most important restriction grows out of the requirement that all acts of the board of aldermen—and of every city functionary—must be in conformity with state law. When it is remembered that the state legislature regulates in greatest detail every phase of municipal administration, fixing not only the general lines within which the city may act, but the minutiae of municipal administration, it becomes apparent that the board of aldermen has little to do. An examination of its minutes show that most of its time is devoted to the passage of resolutions which have no binding effect, a few ordinances dealing with matters not covered by state law, the approval of increases in salaries. bond issues and appropriations, all of which originate in the board of estimate, and the appointment of commissioners of deeds.

The board of estimate and apportionment is a far more important and powerful body. Through its control over appropriations and bond issues. it determines the general policy of the city government so far as it is determined by any local authority. If it does not approve a specific plan, it may withhold the funds necessary to give it effect. If it believes that the city needs public baths, additional parks, play grounds for the children, a municipal lighting plant, free ferries or what not, it has only to authorize the appropriation and the thing is done. And now it possesses the right of granting franchises, whether for street railways, subways, telephones, water. gas, electricity, steam heating or pneumatic service. It is, therefore, the most important body in the municipal government of New York, and has far more legislative authority than the so-called legislative body of the city—the board of aldermen.

The constitution of the board of estimate is unique. It is composed of eight persons, the mayor, the comptroller, president of the board of aldermen and the presidents of the Boroughs of Manhattan, Brooklyn, Queens, Richmond and the Bronx. The first three are elected by the city at large, the others by the different boroughs. In order to give those elected by the whole city a controlling influence, the charter provides that the mayor, the comptroller, the president of the board of aldermen shall each have three votes. The presidents of the Borough of Manhattan and the Borough of Brooklyn, because of the large population of each of these boroughs, are given two votes each, and the others one each, making a total of sixteen votes. As nine votes are a majority, it is evident that the three officials elected at large can out vote the other five members.

The chief peculiarity, however, is that the members of of this board are not elected to their positions as such, but rather as heads of departments. The mayor is the chief administrator of the city; the comptroller is the financial head of the city; the president of the board of aldermen presides over that body; and the borough presidents are chiefly concerned with local improvements. However unusual may be its character and organization, the board of estimate thus far has given very satisfactory results, and its decisions generally commend themselves to public approval—certainly to a far greater extent than those of the board of aldermen.

The chief legislative body for the City of New York is the State Legislature, a *state* and not a *local* authority. If anything of importance is planned, power must be obtained from Albany, and not infrequently party politics is a far more important factor in legislative councils than the welfare or preferences of the city. Every session is clogged with measures affecting New York City, in the main passed and lobbied for by persons who have peculiar reasons for wishing them enacted. The city has found it necessary to keep a special representative at Albany, a skilled lawyer and ex-senator, to protect the city's interests. Notwithstanding, legislative interference has gone so far that two-thirds of the expenditures in the city's budget are mandatory, that is the city authorities have no choice but to include these amounts; they are required to be paid by state law. Of the remaining one-third nearly one-half is practically mandatory, so that only about one-sixth of the city's budget is entirely in the hands of the local authorities. Evidently home rule is largely a myth.

The results of such conditions have been disastrous both for city and state and will continue to be so until some system is established which creates local responsibility. How can one expect that local matters will receive due consideration from those who are in no way responsible or amenable to the locality concerned? The remedy, therefore, is home rule, and preferably constitutional home rule upon the Missouri or California plan, where each city has the right to make its own charter. This implies some sort of local legislative body, which shall have full and complete authority to determine the general policy of the city, to make appropriations, to issue ordinances, or order public works,; in a word, to deal fully with every local matter or need which may arise. The exact nature of this body will largely depend upon local conditions. Chicago believes it wise to build up its council—a body similar in constitution to the New York board of aldermen. New York will probably find it preferable to develop its board of estimate into a truly representative body by certain modifications and to abolish the board of aldermen. The board of estimate at present is illogical and out of harmony with the inherited theories of government, but its record is good and if made more representative would doubtless become an ideal legislative body.

THE PRESIDENT: We will now pass on to the next order of business, which is the report of the Committee on Park Development and Maintenance. Mr. G. A. Parker is the chairman of that committee, but he has not found it possible to be with us, therefore, if it is your wish we will simply read the report by title, and have it inserted in the proceedings. Mr. Parker's reason for not being here is that he has been in poor health lately.

WHAT MAY BE THE TREND OF PARK DEVELOPMENT.

BY G. A. PARKER, SUPERINTENDENT OF PARKS, HARTFORD, CONN.

In order to more clearly see the tendency of the park development of today, it is well to recall the salient points of park growth in the past. The first historical record shows the beginning of what might be called the improvement of grounds surrounding homes within cities to have been the Egyptian patio, which consisted primarily of a paved court nearly surrounded by a building or buildings with loam spaces in the paving for palms or other planting; but the paving predominated. This also was the development of grounds of the other historical nations which were located in the great valley through which flowed the Euphrates and Tigris rivers north of the Persian gulf. To make extensive variations in the topography of grounds for gardneresque effects apparently began in Babylon, culminating in the famous hanging gardens of that city.

The Grecians with their love of the beautiful and keen perception of the ratio and relationship of lands, surfaces and forms in pictorial composition, expended the patio of ancient Egypt into geometrical gardens, structurally correct as to proportions, but simple in their embellishment, although well furnished with garden furniture and ornaments. The Romans adopted largely the Grecian garden, although not so good as to composition, it was highly embellished. From the old Roman garden has come the medevial and modern Italian gardens. Now Italian gardening is not geometrical gardening as some seem to suppose, although straight lines and grades, parterres, steps and balustrades prevail. It was in reality an outdoor room of their country villa made for the comfort and convenience of the people and not primarily for display as is so often the case with our so-called Italian garden. Their parterres were several times larger than the Egyptian patios and different from them in their grass and planting predominated, although there was an abundance of walks and gravelled or flagged surfaces. The Italian loved his parterres. Usually he had two or more of them at different levels connected by steps and protected by balustrades. He had his hedge under the shade of which he walked, with outlooks over the valleys. He had cozy nooks with seats; he embellished his grounds with statuary, and introduced fountains and cascades, but not still waters.

The Moor brought to the Spanish Peninsula the gardening of the Far East which had an influence in modifying the Italian gardens as they spread over France and central Europe, and what is now known as the French, German and Dutch gardening, is largely Italian and Moorish gardens modified by the needs of the people and environments. This style of gardening to have reached its full development of principles, during the age of Louis XIV, when it took on tremendous proportions under the genius and skill of the celebrated landscape gardener, Le Notre.

Continental gardening gained a strong foothold in England some three centuries ago, but being somewhat unsuitable for the climatic conditions it had to contend with, and also not being entirely in keeping with the character of the people, it took on an unsatisfactory form, that is, unsatisfactory for the Englishmen, and became the subject of satire by Lord Bacon and others, until finally Wadsworth, Price, Brown and Ripton broke away from it something over a century ago and laid the foundation of what is now known as naturalistic landscape gardening. Parmateer was the first to practice naturalistic gardening in the United States. Then Downing came with his works and books and laid a solid foundation for it on which the genius of the elder Olmsted is built as the master workmen, the great park systems of the cities, and this brings it down to the present time.

All development of grounds began as a private enterprise. Ownership of land rested in the crown and nobility during most of the centuries that gardening has existed and the right of eminent domain still asserts that the ultimate ownership of land rests in the government. Ownership of land by the people and for park purposes did not become common until after the organization of our government. Somewhere I remember reading of an old Roman Emperor who gave his private gardens and grounds to the people of Rome to be forever used by them for their pleasure. This, as far as I know, was the first time in the world that the people living in a city owned a park. There are many instances where the people have used land in common for their pleasure, but the ownership was elsewhere.

This using land in common was the beginning of the village common and broad streets so frequent in England and which was transplanted to America with the first settlers, and that with the love of the Spaniard for his plaza led to the establishment of public squares, wide streets and pleasure grounds in the old settlements of this country and were quite common before the Revolutionary War. But after that war up to 1850, villages and cities were generally laid out without public grounds. Especially was this true of manufacturing and commercial cities.

In 1847 with the publishing of articles by A. J. Downing began what has since developed into the public park movement. In 1854 there was bought in this country the first acre of land by the public with the public money for purely and simply park purposes by the cities of Worcester, Hartford and New York. The movement extended to several cities, but was checked, in fact almost stopped by the Civil War until 1870, when it began again with a constantly increasing force and it is still growing, and probably this year more money has been spent for park purposes and more acres have been added for park uses than any year previously and next year promises to exceed this.

Now let us see what changes have come since Downing wrote of his conception of what park work means for our cities. First, there came the public square in the midst of the city. Then there was the large scenic park a little outside, followed by the desire to have a series of parks and squares connected by boulevards and parkways and which would serve all sections of the city, making it a well-balanced system both as to territory and population.

The first basic idea in most of this work was to produce public grounds that were beautiful to look upon and where people might find rest for their mind and body and invigoration for their spirit, where they could take the sedate and dignified exercise by walking or riding; but none or little provisions were made for active, vigorous or intense play. But that was to follow. In 1892 the first out-door gymnasium was established at Charlesbank in Boston. In 1896 the first sand boxes were put into public grounds for small children to play in. In 1899 the report of the commissioners for small parks in New York was made. Two years ago Chicago began to realize her project for neighborhood parks and field houses which made the parks useful in rainy weather as well as pleasant, in cold weather as well as warm, and in the evening as well as in the daytime, and they are the modern expression of the pressing need of our present cities. In 1898 the playground movement began to gather strength and during the last year or two has come into full swing. It has spread over this country and throughout Europe more rapidly, more completely than any other movement ever started relating to public grounds. It has come to stay. It differs essentially from all previous movements in that the need of the people predominate and the ornamentation ground is secondary, instead of the reverse which was true formerly.

The question of the systematic and scientific play of children is quite new in its present phase, yet the result so far obtained exceeds the expectation of those who expected the most from it. So much so, that it seems to be another revelation of our Creator to enable us to meet the conditions under which such a large proportion of the people must live in our modern urban life.

A century ago when hardly three per cent of the civilized world lived in cities, it did not matter as much in the world economies if children could not be raised in the city, for the country could be drawn upon to supply the need of human life in cities. But now when it seems probable that at least one-half of the children will be born in the city and must grow up there, it is of the utmost importance that means are provided that they may grow into strong, healthy men and women and free from immoral taints. And as parasitic insects and fungi attack plants which are not vigorous or on the wane, much more easily and severely than healthy plants, so one of the best shields against iniquity for a child is a healthy body; therefore playgrounds not only make for the physical health, but also for the moral health of a child, and one thing that a city cannot afford to get along without are playgrounds for children.

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More than that, ample playgrounds will some time be provided for all men and women who will play, of whatever age, for our modern factory and mercantile life which concentrates a person's energies into one thing, making them specialists in the work of their hands and of their head, to the weakening and atrophying of the functions and organs not used, and play is one of the remedies that will help this. If men will play, they are helping towards removing the evils of modern conditions and there should be no limit to the age period. One of the pleasantest sights I ever saw was in that section of Druid Hill park in Baltimore, which by custom has been set aside for old men, seventy or eighty years old, who every pleasant day have their games and contests at croquet. Day after day these stately old gentlemen come to the park to play this game and to be together. They presented as fine a showing of happy old age as I have ever seen, and nowhere else have I ever seen old men at play, and I was told this had become a habit with men of that age in Baltimore.

This, then, is my answer to the question which heads this paper—that the tendency of the park movement is towards public parks fitted for all the uses which people may have of them, that that fact is to predominate and only after that need is supplied, are the grounds to be ornamented. That structurally they must first be made useful and then beautiful, but fortunately—no, it is not by chance, but by a law of the creation—beauty and use go hand in hand, and what is most useful may also become the most beautiful.

THE PRESIDENT: We will now hear a lecture by Mr. F. G. Todd, landscape artist, of Montreal, on the subject of "Character in Park Design." I have much pleasure in presenting Mr. Todd to you.

Mr. Todd's lecture was most interesting, and very much appreciated by the members present. He threw on the screen several excellent slides of the various parks in Canada and the United States, giving a running description of them and their many points of attraction. Among the slides exhibited by Mr. Todd were scenes from Franklin park, Boston; Municipal park, Galt, Ontario; Strathcona park, Ottawa; Victoria park, Strathford, Ontario; City park, Winnipeg; Fresh Pond park, Cambridge, Mass., and many others.

At the conclusion of the lecture Mr. Todd was heartily thanked by the Society for his most entertaining lecture.

At the conclusion of Mr. Todd's lecture Mr. Harry Bragg, editor of the *Canadian Municipal Journal*, Montreal, was introduced to the meeting, and gave a lantern lecture on "Canadian Cities, Their Location, Position and Attractions." Mr. Bragg uses about one hundred stereopticon slides.

The lecturer explained that the views had been specially prepared, and took the audience from Halifax, N. S., across the continent to Vancouver, B. C., explaining the special features of each city in a rapid manner. He caused some amusement by promising a picture of a "Free Public Art Gallery" and then throwing on the screen a long line of advertising hoardings.

Of the City of Montreal, views of both summer and winter scenes were shown, the speaker urging the visitors to come back again in the winter to see what enjoyment there was then in the dry, cold weather.

He surprised a good many of his hearers by pointing out that in the Canadian Pacific railway Canada possesses the only transcontinental railway in the world, and that it was possible for a traveler to come from England in a C. P. R. steamer, get into the same company's sleeper at St. John, N. B., travel across the American continent to Vancouver, B. C., and then take another C. P. R. steamer across the Pacific to Asia.

Mr. Bragg was heartily thanked by the President on behalf of the members of the Society for his lecture, the President remarking that rarely had he acquired so much information in such a pleasant manner, and that it was a revelation to him and no doubt to many of the members present to learn what beautiful cities the Dominion possessed.

THE PRESIDENT: We will now have to deal with the report of the Finance Committee. If the chairman is prepared to report, we shall be glad to hear him.

Mr. Chausse, chairman of the Finance Committee, presented the following report of the committee:

REPORT OF THE FINANCE COMMITTEE.

Your Finance Committee herewith reports that it has examined the accounts of the Treasurer and found them correct.

The balance on hand on September 2, 1905, was $432.08, and the receipts for the year $650.75, making a total of $1,082.83.

The total disbursements have been $360.91, leaving a balance on hand of $721.92, which must be considered very satisfactory.

The committee has also examined the accounts of the Secretary, and find that he has received $650.75 and has paid the same to the Treasurer.

All of which is respectfully submitted.

ALCIDE CHAUSSE,
Chairman.
AUGUSTUS F. EGGERS,
ERNEST S. BARROW.

THE PRESIDENT: Gentlemen, you have heard the report of the Finance Committee, what is your pleasure with regard to it?

MR. TILLSON: I would move, Mr. President, that it be accepted, and printed in the proceedings.

Which, being duly seconded, was carried.

THE PRESIDENT: We have another paper on "Municipal Parks," by Mr. John N. McClintock. I think that it would be as well to hear Mr. McClintock at this time; is that the wish of the meeting?

It being the pleasure of the members that Mr. McClintock should be heard at this time, he presented the following paper:

MUNICIPAL PARKS.

BY JOHN N. M'CLINTOCK, BOSTON, MASS.

I drove as a lad with a party from the ancient walled City of Chester to the park surrounding Eaton Hall, the home of the Marquise of Westminster, where I received my first lesson in park construction.

One of the most beautiful parks in the world I saw years ago in the Indian Territory; we were hours in passing through it on an express train, and it reached as far as the eye could see on either side of the railway, which was the only evidence of man's occupation of the land. The country was undulating—plains and low hills covered with green grass, with here and there a grove of trees.

We are not now considering private grounds, however beautiful and attractive their lay-out may be, like Eaton Hall park near Chester, nor the broad parks of Nature's own unaided creation, whether among the mountains, by the seashore, or on the western plains; our interest as a Society is in the municipal park, which the Century dictionary defines as

"A piece of ground, usually of considerable extent, set apart and maintained for public use, and laid out in such a way as to afford pleasure to the eye as well as opportunity for open air recreation."

A municipal park should be laid out in such a way as to afford pleasure to the eye and to every other sense. For example, New York Central park is pleasing to the eye because of the grass and the trees, the shrubs and the flowers, the graceful curves and easy grades of walk and path and road, the undulating surface of lawn, ledge and cliff, water in basin and reservoir, bridges, monuments, and other structures.

The paths are hard and firm and shaded, and feel right to the feet; the turf tempts one to recline; the seats are smooth and inviting.

The noises of the city are distant, and one hears only the prattle of children and the wild music of birds.

The water flowing in the fountains appeals to the most refined taste, and satisfies the thirst of man.

The smells of the streets of the great city are kept outside the park, and within only the odor of flowers greets the nose.

Central park is pleasing to the eye and to every other sense because it is beautiful, sweet, clean, wholesome and restful. It was laid out by artists, and nature and art combine to give the pleasing result. It is a harmonious whole; to improve it in any respect is a matter of detail for the specialist.

One of the most pleasing features of a park landscape is a body of water; it may be the ocean, a harbor, a river, a brook, a lake, or a pond.

The water in and about a city should be treated as a part of the park system of the city; it should be kept clean, sweet, wholesome and pleasing to the eye.

The water surrounding or bordering or dividing a city is approached by way of the shore, which also should be kept clean, sweet, wholesome and pleasing to the eye, and a part of the park system of the city.

The water may form a harbor that shelters the ships which carry our produce to every port of the world and which bring back the wealth of the Indies to our shores, but the ships riding at anchor or moored to the wharves do not detract from the natural park-like character of the water of the harbor; they are like swans in the park basins.

The ocean steamer, the river or sound steamboat, the battleship and cruiser, yacht, sailboat, tug and everything that floats upon the water is more or less pleasing to the eye; they do not conflict with the park idea, but form an attractive feature.

The shore of the harbor is required for commerce, but there need be nothing repulsive about commerce. The cargoes of the great ships coming or going are food stuffs, raw material for clothing or building, or the manufactured articles, all of which are largely stored in warehouses.

The marginal street of a city situate on river or harbor may be kept as sweet and clean as the streets in the retail shopping or residential districts, and at night be a well lighted, policed and attractive boulevard;

and in connection with the adjacent river or harbor the most pleasing and popular part of the park system of the city.

The toilers of the city, the laboring men and women of the crowded districts situate near by, have not the time, the inclination or the means to seek open-air recreation in more distant parks far up town or out in the country; the beauty and cleanliness of the park system must be brought near to them or they obtain no benefit from it.

I appear, however, not so much as an advocate for the marginal boulevard as for the reclamation of the purity of the harbor and its incorporation into the park system of the city that has the good fortune to have such a body of water at its doors. I will explain my position more clearly, taking the City of Boston as an illustration.

The Boston park system commenced with Boston Common, which sufficed the town and city as a place for open air recreation for two hundred years, or until the middle of the last century, when the rapid growth of the city and its suburbs, and the example of other cities, brought the city park system into favor and lead to its development.

The Boston park system embraces about four square miles of territory and cost the city sixteen million dollars to construct. It embraces the Common, Public Garden, Commonwealth Avenue, Back Bay Fens, Jamaica Pond, Arnold Arboretum, Franklin Park and Field, Columbia Road and the Marine Park, forming a connected system embracing the older city. It includes Charlesbank, North End Park and Wood Island Park, and an intercepting sewer along the whole harbor front that permits the construction of these delightful resorts for open air recreation.

Boston and adjacent municipalities to the number of thirteen cities and twenty-six towns have been united into a Metropolitan Park District, which is practically the Metroplitan Water and Sewerage District, that surrounds Boston Harbor and has a coast line along Boston Bay from Nantasket to Marblehead. It extends inland a dozen miles from the harbor front, and has a population of about thirteen hundred thousand.

Water has been brought to the district from the highlands of central Massachusetts at a cost of twenty-five million dollars: an intercepting sewer drains the northern part of the district and empties at Deer Island at the entrance of the harbor; Boston sewage flows to Moon Island, near the center of the harbor: the southern part of the district at present drains into the center of the southern section of the harbor.

Where the Boston Park system ends the Metropolitan Park system commences. It is laid out on magnificent lines for the benefit of the present and coming generations, and embraces miles of ocean shore line and square miles of forest and hilltops. The district is drained by the Neponset, Charles, Mystic and Saugus rivers, which contribute to the development of the park system, as do the broad, shaded boulevards connecting the widely separated reservations.

I shall not attempt to describe the Boston Metropolitan Parks; they must be seen and studied to be appreciated; and right here I would hint that Boston is one of the most hospitable and attractive convention cities in the land, and if you cannot gather there collectively the city will welcome you individually with open arms and the glad hand. But I would call your attention to Boston Harbor and its relation to the Boston Metropolitan Park System of which it is the very center and naturally the most pleasing feature.

The Boston Metropolitan Parks have an area of ten thousand acres, or about thirteen square miles; the harbor has an area of about fifty square miles. The park system has twenty-five miles of parkways; the whole harbor is a parkway.

Boston Harbor is practically land-locked, protected from ocean storms by natural barriers, and its surface is broken by numerous islands and irregular shore line formed by bays and coves on the mainland. It should be the most attractive seaside resort in the world, bordered by villas, hotels, camps and club houses. Through the long summer the canoe and sailboat should be seen in every part gliding over the surface, and warships and yachts should be attracted thereto by its safety, its natural beauty, its cleanliness and its sweetness.

In the center of this park-like expanse of water there is to-day a fountain emitting daily a hundred million gallons of putrid nastiness, which floats off with every tide to the physical disgust of everybody brought in contact with it. It is always in evidence.

At the gateway of the harbor there is another fountain of the same character to welcome the stranger to our civilized land. It, also, is always in evidence, as is a third fountain in the center of Quincy Bay.

London has discovered how to abate such a nuisance and has attempted to restore the river Thames to a park-like condition; we know how to do the same in this land, but we procrastinate.

The time has come when public sentiment demands that all pollution should be kept out of our beautiful country parks, our parkways, our marine parks, and the water surrounding them or flowing through them.

By one act of legislation it is possible to add fifty square miles of area to the Metropolitan Park System of Boston, every acre of which would "afford pleasure to the eye as well as opportunity for open air recreation."

In this respect there is a chance for municipal improvement in Boston, and in nearly every American city that is worthy of consideration, for it appeals to all.

Some of you live by the great lakes and broad rivers of the west, where the water at your door is used for commerce, and often as the source of water supply for your own or neighboring municipalities. That water can be made as attractive as the most beautiful section of any city park. It should be so treated in all cases.

We should make every river, every harbor, every lake a pleasure to the eye and to every other sense and thus afford on all water opportunity for open air recreation for the most fastidious person.

THE PRESIDENT: I may say personally I have found Mr.

McClintock's paper one of the most interesting of its kind that I have ever listened to.

Are there any members present who desire to say anything in connection with the subject brought forward?

There being no discussion, we will pass on to the next item of business, which is the report of the Committee on Review. This is one of the most important of all our committees, as you are all aware. The object of this committee is to review and resume what has been done in the way of improvements throughout the country during the year, and the reports of this committee form a most valuable record of what has been done during the several years, in different parts of the country. Mr. Brown is the chairman of this committee, but he informs me that his report is not absolutely completed yet, so we will read it by title, with the agreement of the meeting, and it will be published in the proceedings, and, if desirable, may be discussed at our next meeting.

The report of the Committee on Review is as follows:

COMMITTEE ON REVIEW.

Regarding the cities in the United States, except those in the Atlantic Coast States.

The chairman of this committee was for several years chairman of the Committee on Municipal Data and Statistics and is interested in the question of uniformity in municipal reports. This report will be confined mainly to a consideration of the condition of the various cities of more than 25,000 population in this regard, as shown by their annual reports.

Letters were sent to the mayors and city engineers of all cities having more than 25,000, asking for copies of their annual reports. Seven replies were received stating that reports are not published, others that they are published only at long intervals. These are Dayton, O., Denver, Colo., Elkhart, Ind., Kokomo, Ind., New Orleans, La., City Departments; Omaha, Neb., Seattle, Wash. The fifty-nine cities sending no reports are Akron, O., Bay City, Mich., Birmingham, Ala., Butte, Mont., Canton, O., Cedar Rapids, Ia., Chattanooga, Tenn., Council Bluffs, Ia., Covington, Ky., Dallas, Tex., Davenport, Ia., Des Moines, Ia., Evansville, Ind., Houston, Tex., Dayton, O., Denver, Colo., Dubuque, Ia., E. St. Louis, Ill., Fort Worth, Tex., Galveston, Tex., Houston, Tex., Indianapolis, Ind., Jackson, Mich., Joliet, Ill., Joplin, Mo., Kansas City, Kan., Kansas City, Mo., Knoxville, Tenn., LaCrosse, Wis., Lexington, Ky., Lincoln, Neb., Louisville, Ky., Memphis, Tenn., Milwaukee, Wis., Mobile, Ala., Montgomery, Ala., New

Orleans, La., City Departments; Newport, Ky., Omaha, Neb., Oshkosh, Wis., Pueblo, Colo., Quincy, Ill., Racine, Wis., Rockford, Ill., Sacramento, Cal., Saginaw, Mich., San Antonio Tex., San Francisco, Cal., Seattle, Wash., Sioux City, Ia., South Omaha, Neb., Spokane, Wash., Springfield, Ill., Springfield, O., Superior, Wis., Tacoma, Wash., Terre Haute, Ind., Toledo, O., Topeka, Kan., Youngstown, O. Cleveland stated that last year's report was not yet published and would be sent as soon as issued, but it has not yet been received. Cincinnati sent the report of but one department, that of city engineer.

The following twenty-two cities have sent reports: Anderson, Ind., Cincinnati, O., Detroit, Mich., Duluth, Minn., Ft. Wayne, Ind., Grand Rapids, Mich., Little Rock, Ark., Los Angeles Cal., Minneapolis, Minn., Nashville, Tenn., New Orleans, sewerage and water board, not regular city departments; Oakland, Cal., Peoria, Ill., Portland, Ore., Richmond, Ind., St. Joseph, Mo., St. Louis, Mo., St. Paul, Minn., Salt Lake City, Utah, Shreveport, La., South Bend, Ind. Earlier reports are on hand from Indianapolis, Ind., Cedar Rapids, Ia., Newport, Ky., Kansas City, Mo., Cleveland, O., Milwaukee, Wis.

None of these cities use the standard forms of report adopted by this Society and none of them, except Cleveland, O., uses the form of water works reports adopted by this Society and adopted many years ago in slightly different form by the New England Water Works Association. There is but little similarity in reports even from cities in the same state.

A few of the cities in these lists are of less than 25,000 population, their reports having been on hand for comparison.

Taking a few of the reports received, alphabetically, from the list of cities, the following points from a few of them regarding manner of making the reports and the contents thereof, may be of some interest as examples of the variety of treatment, though few of the items will be very satisfactory in form or contents.

Anderson, Ind., population in 1890, 20,178. 80 pages. City clerk's report 2 pp., contains statements of revenue and its general sources, bonded and floating indebtedness, interest due and balances in funds. Fire chief's report 9 pp. of small details with little of importance. Water works report 4 pp., itemized and classified statement of disbursements and of pipe and hydrants laid. City engineer's report 5 pp., length, kind and total cost of each street improvement since 1891, and summary practically valueless except as a rather indefinite and wholly unclassified statement of the lengths of streets improved. Police superintendent's report 1-9, statement of number of men, salaries and expenses. Health officers' report 2 pp., list of births and causes of death with number of deaths under each. Street commissioner's report, inventory of tools and materials on hand. Gas meter report one-half page, readings on gas meter at beginning and end of year. Garbage report one-half page, barrels of garbage each month, presumably burned, though the only indication of what was done with it is in the one line, "Total amount of garbage consumed in 1903, 30,794." City electrician plant report 2 pp., table of total collections and disbursements each month of commercial plant, and of receipt from city and disbursements each month for street plant. It is difficult to imagine a more ineffective report, a more useless expenditure of printer's ink than in printing it.

Cedar Rapids, Ia., 1901, population 25,656, has the mayor's address and the city reports. The report of the board of public improvements gives a brief invoice of city property. The city engineer's report gives a history of the paving and a statement of the streets paved, showing location, contractor, date of construction, filling of points, length, width, area, total cost and per square yard, kind of brick, kind of traffic and kind of foundation. The same report shows the length of each size of pipe and number of lampholes, manholes and flush tanks; expenses of department, length of sidewalks, and a table of general improvement statistics, showing a beginning, but being far from the standard form. The council committees on streets and walks and light and water show the totals of expenditures and receipts in their departments. The electrical department reports only that he has difficulties. The police department details its arrests, and the fire department shows the value of property exposed, the total expense for maintenance and a general inventory of the property. The park report is an inventory of property. The cemetery committee, the city attorney, the building committee, the clerk of the Superior Court, the board of health, present mainly inventories. The treasurer's report is one of the totals of accounts without system, and the auditor's report is equally barren of real information. The public library report is a plea for funds.

Aside from the city engineer's report, which is far from complete, the money spent in printing this report might well have been saved, except as it probably shows the fact that no information is obtainable aside from that carried in the memories of the officials.

Cincinnati. Engineer department only received, and that is for 1903, 44 pp., contains list of employes in department, list of improvement ordinances. Areas of districts and parks and lengths of streets and alleys with various surfaces. Tables of improvements completed, giving only statement of limits, contractor, dates, cost to city and total cost. Classified by character of improvements. Monthly cost of street gas lighting and table of sewages in five other cities, the payment in Cincinnati being two-thirds this average per light. Like tables of gasoline lighting. Lengths of brick and pipe sewers constructed during year and total each year since 1871, and number of house connections. Tables of lengths, costs and assessments for each sewer, and of plans adopted. Large table of lengths and sizes and appurtenances. Statement of sizes and kinds of bridges over various creeks, rivers and railroads. Statement of sidewalk work done and supervised. The taxpayer who wishes to know what is done with his money would be almost as ignorant after reading this report as that of Anderson. This is not true of all Cincinnati departments, as the summary table of the water works department was included in one of the reports of the committee of this Society on Municipal Data and

Statistics as an excellent example of a close approach to what is needed in that department.

The water works division of the board of public service of Cleveland, O., 1903, is the only department sending a report. This contains a careful study of the meter question and the effect of meters on pumpage. It shows the cost and valuation of the property.

The summary of statistics is on the standard form. The bookkeeper's report carefully classifies expenditures and gives a comparative table for every year, from 1876 to date. The meter department makes a full report of its operations, also the assessing department. The various assistant engineers report their operations—general. The report of water pipe laid shows only sizes and lengths on each street and side street it is laid on. Totals in use are given in one table. Setting of hydrants and valves requires over fifty pages. The quantities of water pumped by each engine each month and pressures are given in detail and summary. The tunnel is described. The special fire main systems is mentioned. Table of salaries is given. Short reports on electrolysis and tests of coal are made and some tables of tests with gauges of pressures and friction losses are given in full detail. The report ends with a detailed report of cost of construction of the various parts of the system to date. This report needs, in addition to the standard form of reports of operation, which it has adopted, the forms of report of construction and operation details which this Society have adopted.

Columbus, O. Report of chief engineer of public improvements only received, and this for 1902, 183 pp., index and city map, 16 pp. of report discussing the various improvements and plans; 8 pp. of insert illustrations. Tables as follows: Expenses of engineer's department, four items. Miscellaneous contracts completed during year, including location, nature, contractor, amount of contract, amounts paid by city, by special tax and otherwise, and rate per foot, 6 pp. Contracts not completed, 1 p. Streets improved under Brick law, giving location, nature, width, contractor, square yards, price, feet of curb, price, feet of circle curb, price, assessment rate per foot, total length, date completed, years of deferred assessments, total cost, 1 p. Streets improved under other laws, with similar statements, 1 p.

Streets improved under private contract, giving quantities, but not prices, 1 p.

Sewers constructed by contract, giving location, contractor, length of each, size and kind and total length of each sewer, amount of contract, cost of superintending and assessing, total cost and rate per foot, 1 p.

Crossings constructed from repair fund, giving location, length, width, area, cost of labor, material and total cost per lineal foot and per square yard, 5 pp.

Cost of market cleaning, seven items.

Receipt and disbursements of sewer funds appropriated by council, 1 p.

Work done by sewer department in cleaning and repair, 1 p.

Location of new catch basins and manholes, 4 pp.

Construction of catch basins and sewers by department, giving location, cost of labor, material and total for each location, 3 pp.

Peters Run sewer repair, 1 p.

Cleaning catch basins, number and cost—detail, 1 p.

Itemized statement of cost and cost per square foot of cleaning and repainting and reflooring bridges, 2 pp. Cost of repairs of bridges and viaducts, 1 p. Unit prices of labor and materials on bridge and viaduct work, 1 p.

Sidewalk repair work, street repairs. Notification of property owner is still practiced here, 1 p.

Receipts and disbursements on steam road roller, earnings exceeding maintenance, 1 p.

Results of analysis and tests of road materials by U. S. Department of Agriculture, various materials from various dealers therein, 7 pp.

Asphalt repair by streets, showing street, limits, total area, area repaired, per cent repaired, repairs in 4-foot gutter and per cent of total repairs, overlaps, concrete used, square yards, total cost, age of pavements, 2 pp.

Asphalt repairs each street for each year since laid, giving kind of asphalt, area year paved, guaranty, cost each year, total cost to date, years out of guaranty rate per square yard per year, 4 pp.

Maintenance of brick, stone and Hayden block streets, giving location, pavement laid, new material laid and old material relaid, square yards, kind of new material, number of new blocks, pounds of pitch used per 100, cost per square yard, total cost, and part paid by water department, street railway or others, 4 pp.

Repairs to similar streets, giving cost of labor, material, and total for each, 2 pp.

Macadam streets repaired, assessments and rate per foot, 2 pp.

Complete list of streets and alleys improved since 1886 under laws as in above table for year 1902, 20 pp.

Length of street in miles improved each year, since 1887, of each kind of improvement, total square yards and total cost of each kind, 1 p.

Streets improved by private contract, areas and lengths and total length of streets paved under various laws, 1 p.

Length of pipe and brick sewers laid each year since 1853, 1 p.

Length and size of sewer, 1 p.

Streets cleaned and sprinkled, times per week, area, price per sweeping per sq. yd., number of sweepings, estimated cost each of machine and hand cleaning and sprinkling, total cost, balance due, per cent to street railway, amount to street railway, feet front, assessment rate, total assessment, 26 pp., and summary by districts, 1 p.

Widths of roadways and sidewalks established, 1 p.

Dedications of streets and alleys accepted, 1 p.

Additions and subdivisions accepted, 1 p.

Streets and alleys vacated, 1 p.

Rights of way for sewers granted, 1 p.
Lengths of street railway rights of way and track, 7 pp.
Park areas in detail, 1 p.
General statistics, 1 p.
Inventories of property on hand, 20 pp.
Inventory of real estate of city, showing uses, 7 pp.
Report of consulting engineer on proposed new dam, 10 pp.
Maps showing wards and streets repaired during year.

This is a complete and itemized report of all the work done under the department, and it is a pleasure for the investigating engineer to find a report from which he can get so nearly all that he may want. It will be noted that but few of the tables extend back of the year of the report, and better judgment in this regard is shown in this report than is often shown.

Detroit. A volume three inches thick, each report independently paged and printed and the order, only, given in the table of contents. Mayor's message discusses the various city problems and gives its financial condition. The comptroller's report is thoroughly classified, detailed and summarized and gives in full detail the indebtedness, sinking fund investments and full details and summaries of all receipts and disbursements of all the various funds and comparisons with other years, and could scarcely be more complete. The sinking funds apparently own all the special assessment bonds issued. Estimates for the next year are also given. The report has 322 pages.

The city treasurer's report is equally satisfactory and occupies 59 pages.

The corporation counsel gives the detail of legal affairs in 32 pages.

The report of the board of education has 166 pages.

The department of public works report takes 43 pages. It is limited largely to statements of lenghts of improvements and total costs, the tables of sewers going into more detail and the tables of streets paved and repaired also being somewhat fuller.

The water commissioners occupy 96 pages. Twenty pages are devoted to a historical sketch, 18 to the classified receipts and disbursements in the secretary's report, seven to the general manager, who gives a page of summary of data which might very easily have been added to and put into the standard form. The civil engineer discusses his problems and gives some valuable data. The meter superintendent, the chief pumping engineer and the superintendent of construction give fully detailed reports of their work. The fire commission report occupies 122 pages and the police commissioner 140 pages. The public lighting commission requires 82 pages to give a description of its system, the cost of the plant, classified by years and by kind of lights, depreciation, distribution of lights, cost of coal, labor, operation supplies, in full detail of classification for each month of the year. It seems to be in sufficient detail to show the exact cost of everything at any given time. The laws governing the department are also given.

The commissioner of parks and boulevards gives a beautifully illustrated statement of the attraction of the parks and apparently full reports of expenditures in arrangements showing the comptroller's influence upon their forms, 74 pp.

The board of health, 92 pp.

Power commissioners, 88 pp.

Public library, 37 pp.; recorder's, court clerk, 22 pp., and house of correction, 27 pp., complete the book.

The city is in fairly satisfactory condition as regards making of reports and could adopt the standard forms of report almost without labor. The methods of keeping accounts are such that the standard forms could be used quite as readily as those used. There are some additional items in the standard forms which it would be advantageous to add to the Detroit reports, particularly that of its department of public works.

These remarks give a fair idea of the variations in quality of reports which will be found in going through a pile of them collected from cities of various sizes in any part of the country. Specially good features will be found in each report of the larger cities, but two cities seldom happen to hit on the same item for elaboration and never hit upon the same form unless it is laid down by law.

Special attention is called, however, to the excellencies of the report of Duluth and Minneapolis, Minn. The Minneapolis system of accounts has been described to this Convention by one of those instrumental in establishing it. The city engineers and water and light boards seem to have imbibed some of the same spirit, and while their reports are not always as thorough as those of the financial departments they are much above the average of such reports and only lack the conformity to a common standard to make them models in fact as they are in spirit. What is needed is detail and accuracy in the reports of what is done equal to those used in the financial reports.

The labors of the Committee on Review would be greatly reduced by the adoption of these uniform forms of report and steps toward making known the work which this Society has done in this line are recommended by this committee.

Perhaps of the collection of a city's statistics none put in the hands of a single official, with power to require forms of report, if not of accounting, would help to bring order out of the present chaos.

The later developments in municipal improvement are taking the line of beautifying the cities. The "group plan" is a popular proposition at this time. None of these have progressed very far at the present time, but several are nearing the stage of beginning actual construction.

One of the most elaborate of these plans is that of Cleveland. It proposes the groupings of the new public buildings which must be constructed shortly, the ends of a parkway, the purchase of the property on each side of the parkway and its resale under restriction so that the adjoining business blocks will be in conformity with the designs for the public buildings, and bridges over the tracks at the entrance to the city from the railroads leading to a park area, along the lake shore. The land for the public buildings has already been secured and contracts with the railroads and purchase of other property desired are under consideration.

St. Louis has recently proposed an equally elaborate scheme, not far different in general design, which has not yet progressed beyond the stage of preliminary plans.

New York has had an ambitious proposition under discussion for the new city buildings, especially as regards the height of one of the buildings.

A plan for the construction of certain new public and semi-public buildings in certain locations to form parts of an organic whole has been proposed for Indianapolis, by a member of this Society, but this also is only in the preliminary stage, no drawings having been prepared.

The Cleveland and St. Louis plans have been prepared by commissioners and the plans of building in New York must be approved by a Municipal Art Commission. These commissions demonstrate the development of the idea of beauty in the American city and are the first steps toward an intelligent control of public art and architecture which is bound to result in greater unity in architectural ideas for both public and private dwellings. We have a race of people—American originally, heterogeneous in origin and characteristics. This condition shows in the lack of unity and stability of our architecture, both public and private. The fusing of these elements into a homogeneous whole is progressing and is showing first in the reaching out after better plans for our public buildings, and will be followed by similar efforts regarding private buildings. Cities generally need municipal art commissions like those making the preliminary plans for the Cleveland and St. Louis "Groups" and the Bridge and Stream Improvement Commission of Indianapolis, but with the greater field and the greater powers which belong to New York. Municipal Art Commissions supplemented by power to advise, if not to control private structures in prominent places and where they will affect the appearance of public improvements.

CHAS. CARROLL BROWN,
Chairman.

THE PRESIDENT: Before we adjourn there is another paper entitled "A Review of Municipal Work in the Atlantic Coast States Since 1880." Mr. Hatton is not here at the moment, and as the hour is somewhat late, I think it would be as well for us to read his paper by title only, and have it printed in the proceedings.

Mr. Hatton's paper is as follows:

A REVIEW OF MUNICIPAL WORK IN THE ATLANTIC COAST STATES SINCE 1880.

The writer had in his mind, when he was requested by the chairman of the Committee on Review to prepare a paper reviewing the municipal work done in the Atlantic Coast States, to give actual figures showing the amount of the important work done in this line since 1880 by the larger cities in the East, and for the purpose of obtaining the statistics at first hand, he prepared and sent out sixty-five circular letters to the mayors of that number of cities, from which he received just sixteen replies, which were insufficient to enable him to carry out his purpose. However, by referring to the United States Census Reports for 1900, and to that most excellent compilation of municipal statistics, The Municipal Year Book for 1902, as edited by M. N. Baker and published by The Engineer News Publishing Company, and by hurried inquiries to several associates, the writer has been able to partially cover the subject matter, which, being in a condensed form, he hopes may prove of interest and benefit to the members of this Convention.

The municipal improvement of first importance has been the development and construction of public water supplies, and the measures taken for supplying pure water, and protecting the sources of supply against possible pollution. In 1900 there were 656 cities and towns in the Atlantic Coast States, having a population of 3,000 or over, which had a public water supply either operated by the municipalities or owned and operated by a company under a franchise. Since then the writer learns that there have been built thirty-seven new plants, making a total of 693 plants. Most of these plants have been largely improved by extensions to the distribution systems, increasing the power to deliver the water, enlarging the reservoir capacity, and what is most important, many of them have had added some system by which the water was purified before being delivered to the consumer. Prior to 1880 but little thought was given to the purification of water for domestic use, but since that time there have been built 151 water purification plants in as many cities and towns in the Atlantic Coast States. The greater number of these plants have been constructed for water works which are operated under a franchise, apparently indicating that communities are much more particular as to the quality of water used when it is supplied by private interests than they are where they have to pay the bill for purification methods themselves. The greater number of the purification plants are operated by the mechanical filtration process, and a few are operated by slow sand process and by coagulation, sedimentation, filter cribs and by softening process. The largest plant which has so far been constructed for the purification of a domestic water supply is the one which is now nearing completion at Philadelphia, Pa., and the next in size is the one about completed at Washington, D. C. Both of these plants are built upon similar lines and are worthy of a visit from any member of this Society, as being the most improved type of slow sand purifiers in this country, if not in the world. The class of work done at both plants is as fine as the writer has ever examined, and in spite of the investigation now going on in the Philadelphia plant, it seems certain to the writer's acquaintances who have carefully examined the plant that but few flaws will be found in the construction, or in the materials used. The cost of this plant to date has been about $22,500,000, and it is estimated that it will require about $4,000,000 additional to complete it. The minor portion of the filters are already in use, and are supplying a portion of the city with reasonably pure and wholesome water from a highly polluted source. A large portion of the Washington filter plant has been completed, but not yet put in operation.

Among the larger water purification plants in the East might be mentioned the one which filters a portion of the New York City supply, Boston, Albany, Lawrence, Binghamton, Elmira, Poughkeepsie, Hoboken, Paterson, Allegheny, Chester, New Castle, Wilkes-Barre, York, Norfolk, and Atlanta. One of the most recent and best equipped mechanical filter plants is the one constructed at Little Falls, N. J., and is well worthy of inspection. But a few years ago the number of municipal filter plants could have been counted upon the fingers of two hands, but since 1890 the feeling has firmly taken hold of the citizens of the Eastern municipalities that their first duty is to provide pure and wholesome water for domestic supply, and that the time, money and labor expended for this purpose has been of great advantage to this country is best exemplified by the large decrease in the annual death rate from water borne diseases since 1895.

Twenty years ago the average citizen of this country looked upon typhoid fever as a punishment sent by Providence which could not be avoided but must be endured; now, however, the most ignorant have a well fixed idea that the disease can be easily prevented by protecting themselves against an impure water supply. The Indians of the Southwest used to think that smallpox was sent by their Deity as a punishment for their sins, but they have recently found out that man can prevent the punishment by very simple methods.

The improvements made to the source of water supplies during the last decade have been numerous. For instance, the large impounding dams built by the City of New York for insuring a supply of water during dry weather can hardly be duplicated anywhere in this country. The system of impounding reservoirs built by the City of Boston to preserve its water supply are good examples of how the American cities are providing for their future water supplies, while many minor cities of Pennsylvania have built impounding reservoirs of much magnitude, few of which are ever described in technical journals.

Coincident with the measures taken for the purification of the water for domestic purposes has been the works undertaken by the cities of the Atlantic Coast States for the proper disposition of this water after it has been soiled by use, and sewerage systems of great magnitude and costing enormous sums of money have been constructed. Prior to 1880, with but few exceptions, sewers were principally built by cities and towns for carrying off the storm water, and incidentally they were used to carry off the liquid household and manufacturing wastes. The writer has knowledge of eight of the larger towns, one a city of over 300,000 population, which up to a few years ago prohibited by ordinance the discharging of any sewage into the sewers of the municipalities. Few sewer systems were designed as an intelligent whole, but were mostly designed and constructed for the immediate needs. The larger cities carried the storm water and sewage through the same conduits to the nearest available natural water course, which soon became merely an open sewer, polluting the atmosphere in its vicinity, and frequently the domestic water supply of a neighboring city further down the stream.

For some years past, however, communities have been realizing that the primary use for sewers is to carry off underground the liquid wastes and that it is the duty of those contributing sewage to so dispose of it that it may never become a nuisance to themselves nor to their neighbors, and that the disposition of the storm water is of secondary importance. The result has been that sanitary sewers have been built in all the larger Eastern cities to a greater or less extent so as to afford all the inhabitants ample sewerage facilities, and the smaller towns and mere villages are rapidly following suit. In fact, it is the exception at the present day to find a town of 3,000 population or over in the Atlantic Coast States where sewers have not already been constructed or a system is being strongly talked of. From the indications suggested by the replies to his circular letter sent to the several Eastern cities, the writer believes that there have been more miles of sewers built in the Eastern cities since 1890 than water mains and that the money expended for them has been of a larger amount than for any other municipal improvement except street pavements.

So far as the writer has been able to learn there have been constructed since 1880 in the cities of the Atlantic Coast States eighty-three municipal plants for the purification of sewage, or more than one-half as many sewage purification plants as domestic water purification plants. In the early days of sewage purification in this country the process most generally used was intermittent filtration, and several large and fairly well operated plants were constructed on these lines. There are thirteen such plants in operation in Massachusetts alone, the largest of which is the one at Brockton. For a time chemical precipitation was a popular method of disposing of sewage and several such plants were constructed in the New England States and in New York and New Jersey. The largest plant in existence in this country, if not in the world, is the one at Providence, R. I., which has recently been completed and which provides for the purification of all the sewage from the city and a portion of the storm water, represented by the first washings of the street surfaces. The chemical precipitation plant which has no doubt contributed the most information to the United States upon that process of purification is the one at Worcester, Masss., which has been intelligently operated for a number of years. Among the larger sewerage purification plants in operation in the Eastern cities might be mentioned those in Clinton and Marlboro, Mass., Central Falls, Pawtucket and Woonsocket, R. I,, Meriden and Danbury, Conn., Kingston, New Rochelle, New York City and White Plains, N. Y., Long Branch and Plainfield, N. J., Altoona and Reading, Pa., and Wilmington, N. C.

The process which in recent years has become the most popular is the septic tank, with or without subsequent filtration, through contact beds, sand or ground. So far as the writer has been able to learn there are at the present time some thirty-eight such plants under construction in the East. The cheapness of construction and operation has appealed to the average city father, hence the great popularity of this process.

The major portion of sewerage purification works have been constructed in Massachusetts, Connecticut and Rhode Island, owing, no doubt, to the dense population and the abundance of surface water supplies. The States of New York, New Jersey and Pennsylvania are rapidly coming to the front, however, and are insisting that crude sewage cannot be discharged into the natural water courses of the states. Excellent laws have recently been enacted in these three states which make it obligatory upon a municipality to purify its sewage by some approved method before dumping it into the streams, and within a few years the writer believes there will be but few cities and towns in these states which do not practice sewage purification. The question has not yet been seriously taken up in the Southern cities, for the reason, no doubt, that the population is much less dense and sewerage systems are just being constructed, but the Southern cities are making rapid strides in municipal improvement and the day is not far distant when the Southern States will pass such health laws as will amply protect their streams.

More of the public's money has been expended in securing improved street surfaces since 1880 than for any other municipal purpose, and since that time the cities of the East have assumed a far different appearance. Hundreds of miles of granite block, fire brick, street asphalt and bituminous macadam have been used, laid upon all kinds of foundations and costing millions of dollars. Of these several classes of materials mentioned granite blocks have been used where the traction is heavy and upon a restricted area; sheet asphalt in the retail districts of a city and in some of the residential portions; bituminous macadam and fire brick have been principally used in the residential sections. Aside from these permanent pavements, many miles of macadam and telford roadways have been constructed in suburban districts. From information received from the several cities heard from the cost of the several classes of pavements referred to, except bituminous macadam, which is a comparatively new class, is about thirty per centum less than it was in 1890, although the cost of labor has materially increased since then. In the writer's judgment the decrease in cost is due to the manufacturer and producer taking less profit for his goods and the contractor less profit for his labor. It would take up too much space in this paper to specify the beautifully paved streets in most of the Eastern cities, but he cannot refrain from mentioning those of Boston, New York, Brooklyn, Providence, Newark, Trenton, Philadelphia, Baltimore, Washington and Atlanta, Ga., as being samples of well paved cities, nor can he refrain from calling attention to the general cleanliness of the streets of these cities. Prior to 1880 the cleaning of the streets of our Eastern cities was a spasmodic occurrence, usually done during the day when those whose duties kept them upon the streets usually received large volumes of the dirt and dust stirred up by the brooms. But now the streets are regularly and systematically cleaned so as to be of as little nuisance to the citizens as possible. Prior to 1880 every city of any size in the East had its slum, and they were slums, indeed. The municipality did not seem to realize the duty it owed to itself to look after the cleanliness of this district, and the streets were poorly paved, if paved at all, more rarely cleaned, and poorly lighted. It seemed to be a question of dollars and cents to the city fathers; that is, there was but little taxes gathered from the inhabitants of these slums, hence they did not deserve the improvements which were enjoyed by the rest of the community which paid the bulk of the taxes. Now, however, the authorities recognize the fact that they are protecting the health of the whole community by making the surroundings of those who must necessarily live in the slums as clean as possible, the result has been that but few of the old-fashioned slums can at this time be found in any of the larger eastern cities. And some have even gone so far as to exercise a judicious supervision over the interior of the homes of this careless class, compelling cleanliness. This condition has been brought about largely by philanthropic work, but the conscientious city officer has had his just share in it by first providing sewers, street paving and lights to these districts and thus educating the inhabitants in a practical manner how their conditions might be bettered.

One of the greatest improvements in municipal affairs since 1880 has been the lighting of the streets. Prior to 1880 there were but few electric lighting plants in the United States, most of the street lighting being done by gas or coal oil, and even these lights gave little illumination, and the going through the streets of a city at night was not much better than traveling on a country highway. Since 1890, however, cities and towns and nearly every village of the Atlantic Coast States are lighted to a greater or less extent by electricity and the majority by arc lights of large candle power. The young man or woman twenty years of age or less cannot conceive of the change in conditions these increased lighting facilities has resulted in; nor can he of more mature years realize it until he recalls that when he was a young man it was a rare thing to see his women folks upon the streets of his city at night without an ascort. Now our nights are almost like the day and our chief recreations are enjoyed after dark, a condition which is no doubt the result of our improved lighting facilities. To give an idea of how the business of electric lighting has grown since 1890, the writer takes from his replies received from the cities written to the following information:

One city which in 1890 had 1,125 arc lights now has 3,731.

One city which in 1890 had 195 arc lights now has 2,800.

One city which in 1890 had 50 arc lights now has 989.

One city which in 1890 had 94 arc lights now has 811.

One city which in 1890 had 587 arc lights now has 1,906.

One city which in 1890 had 149 arc lights now has 329.

The cost of lighting with electricity has decreased about 30 per centum since 1890, and a still further decrease is expected.

For many years the maintenance of the wires upon poles throughout the densely populated cities was a menace to life, as these wires carried a deadly current and were constantly liable to be broken and come into contact with man or beast; but since 1890 in most of the larger cities and in many of the smaller ones these wires have been placed underground in conduits built either by the companies owning them or by the municipalities and rented to the companies. For instance, in Washington, D. C., no wires are allowed to be strung above ground upon or over the streets, and in many sections of New York City, Philadelphia and Boston the same is true. Baltimore has for years been constructing an intricate system of conduits for carrying the wires, and will soon have it completed. It is perhaps the best sample of a conduit system in existence in the Eastern cities.

Coexistent with electric lighting is the electric railway systems of the Eastern cities. In 1880 there was no such thing as a "trolley car," and those who traveled by public conveyance through the streets of a city were forced to patronize the now unfamiliar horse and mule tram car, still sometimes seen in New York City, when, to the writer's little daughter it was the most curious sight she witnessed during a recent visit there. Now every city and town has its extensive trolley system which gives as good transportation facilities as the steam car gave three decades ago And the trolley car has been relegated to the rear in some of the larger cities where distances have become great, and the rapid transit subways are the thing of the present and future The Boston subway is the first venture in this line in this country, and is a magnificent sample of engineering. The usefulness of this property was soon made manifest to the city officers of all large cities, and within a few years after Boston's venture New York City constructed the first portion of its subway system through which a passenger is carried through .or under the city as rapidly as though he was out in the country districts. The New York subway system has just been begun and its extensions as outlined at the present time will cover a great portion of the island and reach into Brooklyn, and heaven of the overworked street car horse of New York is in sight. The engineering feats accomplished and the obstacles overcome in the successful building of the New York subway have never been paralleled in the world, and for many years to come will stand forth as the most tremendous undertaking of any municipality in the world, for it is a purely municipal undertaking built by the City of New York and leased for a term of years to the present operators. The subway at Philadelphia is being rapidly built, and although a large and expensive piece of work is but a simple proposition when compared with the New York subway and unlike the latter is being built by a private corporation, and for the present time, at least, with a view only of assisting rapid transit on Market street, the principal thoroughfare of the city, where more street cars run on the surface per hour than upon the street of any other city in America. The City of Pittsburg is now contemplating giving franchises for the construction and operation of an underground subway for electric cars, and by the end of another decade we may expect to go to our suburban homes by means of underground railways instead of by surface tracks.

A much needed municipal improvement which has not kept pace with the rapid development of the cities of the East is the proper disposal of the garbage, and there is perhaps no question to-day which is giving the municipal officer more concern than this very question. For several years past many systems of disposing of the garbage of cities have been introduced and tried with some success. These systems have been patented by the several inventors, many of whom knew little about the matter, and as a whole they are conceived, built and operated upon purely unscientific methods. So far as the writer knows there are at present being operated about eighty-eight plants in as many cities of the Atlantic Coast States for the reduction, cremation or other artificial disposition of garbage. Some of those he has visited are performing the work in a fairly sucessful manner, but the majority seem far from perfect. It seems that there is a wide and useful field for the scientific and sanitary expert in garbage disposal, and many cities in the writer's knowledge would welcome the introduction of a garbage plant that could be relied upon to perform the services required within a reasonable expense. From data secured from the several plants visited by the writer at various times there is no uniform ratio between the amount of garbage disposed of and the cost per ton. This may be largely the result of ignorant management of the plants, and not so much from the design of the process, as it has occurred to the writer that the most inefficient class of labor is employed in this work. As the cities grow the garbage grows and the question becomes more serious and but few cities in the East have met it squarely.

A review of municipal work in the cities of the Atlantic Coast States is one of large magnitude, and to cover the question perfectly would require much more time and a greater length of paper than the Society would care to have. The writer would have liked to touched upon the improved methods of plumbing regulations as adopted by most Eastern cities during the past few years, showing what advances have been made in this particular towards the protection of the public's health. He would also like to have dealt in a similar way with the improved building regulations which have become necessary by reason of the construction of the modern office building, the installation of public parks throughout this section of the country, and the improvements to private premises which always follow public improvements, and many other features which are fit and interesting subjects for review, but space forbids that these be more than mentioned.

The bulk of municipal improvements in the Atlantic Coast States has been in the New England States, New York follows closely and New Jersey and Pennsylvania are not far behind. Maryland and Virginia are getting into the procession and the Carolinas, Georgia and Florida are just beginning, but the fever is there, and in another decade the South will be able to offer the homeseeker just as comfortable surroundings as can be found anywhere upon this continent. To the writer it seems that public progress has kept pace with private improvements in spite of the handicap which politics always places upon it.

Very respectfully submitted by
T. CHALKLEY HATTON,
Member of the Committee on Review.

The meeting thereafter adjourned.

THIRD SESSION.

The third session was called to order at 8:25 Wednesday evening, September 6th.

The first order of business was the report of the Committee on Street Paving. Mr. C. D. Pollock, Brooklyn, N. Y., chairman of the committee, presented the following report:

REPORT OF COMMITTEE ON STREET PAVING.

Nothing startling in the way of new pavements has been developed during the past year.

The progress has been in attempts to improve pavements and to cheapen the cost of construction of our standard pavements, and also the repairing of them.

Your committee has secured a paper on the organization required for the proper maintaining of pavements. Very little has been written on this subject, or at least put into tangible shape. We hope that this paper will bring out valuable discussion.

The Department of Commerce and Labor published a circular last April compiled from consular reports describing glass paving and building bricks. These have been used to a small extent, principally in Germany and France, for paving purposes, but more generally as tiles.

Much interest has been taken in the use of oil on macadam pavements. Pavements of macadam are cheap in first cost, but as repairs begin as soon as the pavement is completed, the maintenance is very high, making it actually an expensive pavement. For the proper maintenance of macadam and the comfort of those driving on this pavement sprinkling is imperative. This in itself is a big expense.

If the use of oil will save the sprinkling with water and can be used at a reasonable cost, the cities and towns having much macadam to maintain should know more about this subject.

Numerous localities have tried sprinkling oil over macadam, but we have learned of no very successful attempts in the East.

The failures here may have been through the use of the wrong oil, or through improper manipulation, or both.

California has had marked success with oil in many places. Her engineers have made careful trials until they seem to have hit upon the proper method and the right oil. We are very glad to have secured the paper on this subject from Mr. Theodore F. White of Los Angeles, Cal., a man of large experience in this method of road building.

We have secured another paper in connection with macadam, a paper on gutters and cross-walks for this pavement. These are always hard to arrange satisfactorily with a soft pavement surface and any help on this matter should be welcomed.

We hoped to have secured a paper on the action of water on asphalts, but owing to various causes we found it impossible for this year. However, this is a good subject and we recommend it to the consideration of your next committee.

Last year your committee presented a paper on a "Municipal Laboratory for Testing Materials," this year we have a paper on the importance of this testing.

We will not take any more time, as we know you wish to hear the papers instead.

Respectfully submitted,
C. D. POLLOCK,
Chairman.

THE PRESIDENT: The papers which this committee have to present are one by Mr. Stewart, who is in town here, another by Mr. Fort, who is not in the city, I understand, and another by Mr. Howard. I understand that there is also a paper by Mr. Theodore F. White of California.

According to our rule, none of those papers should be read till the authors are present to read them, but perhaps it would be the pleasure of the meeting to have the Secretary make an exception in this case and read those papers, because this is a very important subject, and I understand that all the papers are very interesting.

Mr. Rust: I would move that an exception be made in this instance, and that the Secretary read the papers of such gentlemen as are not here, in connection with this subject.

This motion being agreed to, the Secretary read the following paper, contributed by Mr. Theodore F. White, Los Angeles, California:

THE USE OF OIL ON MACADAM PAVEMENTS.

BY THEODORE F. WHITE, LOS ANGELES, CALIFORNIA, MEMBER OF THE ADVISORY COMMITTEE, NATIONAL GOOD ROADS ASSOCIATION.

Mr. T. D. Allin, city engineer of Pasadena, Cal., with whom I had a very pleasant acquaintance for a number of years, has forwarded me your chairman's letter to him of July 20th, in reference to preparing a paper or furnishing data on "The Use of Oil on Macadam Pavements," requesting me to take the matter up, as he did not feel able to do so, on account of lack of time and poor health. I regret the cause of Mr. Allin not complying with your request, for he has given the use of oil on streets and roads much study, and his experience fits him for handling the subject. However, the writer will endeavor to touch upon some points in this class of road construction, deduced from his experience of several years in this connection.

The oiling of roads and streets in California first began to attract particular attention about six years ago, when petroleum oil was used in Los Angeles county in a small way in 1898, and more in 1899, followed by San Bernardino county in 1899, when the writer was a member of the board of supervisors of that county, and by virtue of his office one of the road commissioners.

The first use of oil on roads had for its object the laying of dust, which was almost unbearable during the long dry summers of California. It was used for this purpose instead of water, sufficient quantities of the latter being difficult to obtain in some sections, and it was thought that the oil would have a more lasting effect, and so be more effectual and economical for this purpose. It was found to be an excellent dust layer. All grades of oil were used, from high gravity, containing but a small quantity of asphaltum, and charged with water and sediment, to heavy oil, free from water, and very rich in asphaltic base. No attempt was made in the beginning to obtain a hard, smooth-surfaced road. The idea was to mix the oil with the natural loose surface dirt of the road in sufficient quantity to make it heavy, so that the dust would not rise. It was thought that it would be a waste of material to use oil on a loose sandy road, that it would simply sink into the sand and disappear, and if used on a hard surface like macadam it would not penetrate, but run off into the gutters. Even the parties who claimed to be the discoverers of this use of oil, and to have a patent on its use, (but who have never been able to substantiate their claims) said that there must be a loose covering of at least an inch in depth on the road to mix with the oil.

One of the first things noticed was that the larger the percentage of asphaltum and oil, the firmer it made the surface of the road, and so the better the results. Another was that if the oil was worked in deep, especially in clay soil, it made a spongy roadbed that was very heavy for hauling over, and that the oiled layer became rutted and ridged and very uneven. There are miles of just such roads in California to-day. Teamsters condemn them, and they are very unsatisfactory, on account of their unevenness, for even light rigs. It was found that sandy and gravelly surfaces absorbed the oil readily, and became very hard if a heavy asphaltic oil was used; that even loose drift sand, while it took a large quantity of oil, put on in a number of applications, and considerable time to set and harden, could be converted into a smooth, hard-surfaced roadbed. But an absorbent, hard compacted gravel surface, it was found, made an ideal oiled road, when a heavy asphaltic liquid was used. This led up to the use of this kind of oil upon macadam roads, and now we are building what we call "liquid asphalt" roads and streets, giving careful attention to all details of carefully preparing the subgrade, putting down the crushed rock layers, filler, etc., and thoroughly compacting this base to a hard, smooth, properly shaped surface, to receive the oiled, or rather asphaltic covering, and obtaining a result that is very similar to the regulation asphalt pavement, hard, but not quite so hard and smooth as the latter, but furnishing a better footing for the horse. A surface that does not get slippery in wet weather, a surface that is slightly elastic, very pleasant to travel over, and which effectually preserves the macadam below.

The construction of this "asphalted macadam" road or street involves the careful building of the macadam base, acording to the most approved specifications for this work, attention being given to proper drainage and to the crowning of the surface. It must be remembered that this base supports the load that goes over it, and that the superimposed asphalted layer is a comparatively thin, slightly elastic, protective covering that takes the surface wear.

The macadam base in this climate is made from four to six inches in thickness, acording to the firmnes of the sub-grade, and the load which the road has to carry. It should have a cross section that will insure the storm water reaching the gutters soon after it falls, and the surface should be smooth and even, without depressions. Catch basins on the surface, where the water will stand, would be a very serious defect in this kind of roadbed. The constant travel over the spots covered with water would cut through the surface layer, and unless repaired, a hole would form.

Granite, trap and limestone are commonly used in this macadam. A dense limestone is excellent for this purpose It can be compacted into an unyielding base without voids, while the asphalted layer protects it from the abrasion of travel.

After the macadam base has been carefully prepared, the most approved plan for putting on the liquid asphalt covering is as follows: The surface of the base being free from all debris or loose material, clean, smooth and hard, a thin layer ¼ to ⅜ inch thick, of fine angular gravel, or coarse, sharp, clean sand is spread upon it evenly and of the exact thickness required. Upon this is applied the liquid asphalt or heavy asphaltic oil, put on at a temperature of not less than 150° F and in quantity ⅗ to ¾ of a gallon per square yard. The liquid is likewise put on by a machine that spreads it evenly over every particle of the surface, and in the exact quantity required. It is desirable to let the liquid remain for at least twenty-four hours without being disturbed, under the warm rays of the sun, that it may penetrate the base as far as possible, to secure a good bond between the base and covering. Then another thin layer of the sand or gravel is spread over the surface. and a second application of the hot liquid is put on like the first, from ⅖ to ½ gallon per square yard. This is followed by a third layer of the sand or gravel, sufficient to completely fill the liquid with grit, and leave no stickiness upon the surface. Sometimes a plank "smoother," 6 feet long, made of 2x8 or 2x10 inch hardwood plank, put together ship-lap fashion, is run over the surface, lengthwise, crosswise and diagonally after the second application of the liquid, before the third sanding, if the liquid does not pick up, but *after* the third sanding, if it does, to more thoroughly mix and pulverize any large particles of the gravel layer. If the "smoother" is run over the surface after the third graveling or sanding, then another light sanding is put on after the smoothing. This is to prevent particles of the oiled layer, while it is still "green," from adhering to the wheels of vehicles or to the feet of horses traveling over it.

As soon as the last layer of gravel or sand is put on, a light or medium weight roller may be run over the surface, and the road or street may be thrown open to travel. If the travel on the street is considerable, the rolling just previous to throwing it open may be omitted. After the street is so thrown open should any "wet" spots develop from there being an excess of the liquid, a little more sand should be put on, just sufficient to take up the liquid and remove all stickiness.

After the street has been traveled two or three weeks, should the surface not be entirely smooth, then a medium weight roller, say 2,000 lbs. to the foot-width, may be run over it with much benefit, to iron out the uneveness and little creases made by travel. This rolling may be repeated at intervals of two or three weeks, for a number of times during the hardening process, but it is frequently omitted altogether. The travel, if considerable, will work the surface down smooth, but the rolling will make a better looking job. The result is a smooth, firm, rubbery asphaltic surface, that continues to harden for some months after the work is done, until it becomes as hard and almost as smooth as an asphalt pavement. In fact, it is an asphalt pavement, but got at a small fraction of the cost of the regulation pavement made with hard asphaltum.

The asphaltum being used in liquid form on the macadam, as above described, takes much longer to set and harden than in the pavement, where the "D" grade asphalt is used; on the other hand the liquid asphalt has none of the properties that go to make asphalt a good paving material, injured by a high degree of heat, which sometimes happens in reducing it to the hard form. It has, therefore, a longer life and more elasticity after it does set and harden than some of the hard asphalts.

The liquid used to secure the best results has a gravity of about 10.5° B. and contains over 80% of "D" grade asphaltum, over 90% of asphaltum in liquid form, and comes from what is called the "Sunset" Fields, near Bakersfield, California. A sample of this liquid recently submitted to a careful test showed as follows:

Gravity, at 60° F.	10.3 degrees B
Water	None
Volatile, when heated to 400° F for a period of 10 hours...	17.2%
It was then reduced to asphaltum having a penetration of 55°	82.8%
This is equivalent to liquid asphalt	90.0% plus

It is to be noted that commercial "D" grade or hard asphalt has a penetration of about 60° so that the above 82.8% was a little harder than the commercial hard asphalt.

The fine gravel or coarse sand used with the liquid should have good wearing qualities and be sharp and angular. The nearer it is to pure silex the better. The idea of the liquid-asphalt-gravel surfacing is that the asphalt is simply a slightly elastic cement to hold the grit with which it is filled together, to make a durable wearing surface and protect the supporting base below. In building a street as above described, after the base is prepared, it is absolutely necessary to keep travel off the portion being treated with the liquid. If the street cannot be closed altogether, then one side should be worked at a time, keeping the travel off this until it is finished, ready to throw open to the public before the other is undertaken.

It may be pointed out that our experience with this class of roads and streets has heretofore been mostly in the climate of California, and they have been built during the summer season, when it is dry and warm. It is important that the surface of the base be dry, and better warm, when the liquid is applied, otherwise a good bond will not be secured and the covering will be inclined to peel off. It is therefore sugested that in building such a road in a climate where there are frequent rains that the liquid be put on during a warm dry period, when rain is not liable to fall during its application. After the liquid is spread and it is filled with gravel or sand the rain will do little harm.

Examples of asphalt-macadam roads and streets can now be found in a number of places in California. Probably the first was built by the writer and a fellow member of the board of supervisors of San Bernardino County, between the City of San Bernardino and Colton, in 1900. Riverside now has miles of streets so covered that are noted for their excellence. Los Angeles has lately adopted specifications for this class of work, and other cities and towns are following suit.

THE PRESIDENT: It seems to me that it would be better to discuss each paper as it is read. Of course, if the members think differently, why, they have only to say so.

There being no dissenting voice, I will declare Mr. White's paper on the "Use of Oil on Macadam Pavements" open for discussion.

MR. EGGERS: I would like to ask what the cost of a square yard would be under that process?

MR. POLLOCK: Mr. White does not state in his paper what the cost is. Of course, it would be very diffierent in California from what it is here. You would have the cost of the transportation of the oil, and the difference in labor conditions, and so on.

Mr. White says that it is but a small fraction of the cost of an ordinary asphalt pavement in California, and as you know they have asphalt, as well as asphalt oils right there on the ground.

MR. EGGERS: It would be interesting to have some details as to the cost.

MR. TILLSON: About the Fourth of July I had occasion to make a short automobile trip through Long Island, and on part of the journey we went over the roads that had been used for the Vanderbilt races, by the automobilists—those roads had been oiled, and I was so much pleased with them that after I returned to the city I wrote to several people in connection with the matter, and after considerable correspondence I got in touch with the contractors who did the oiling.

They told me that they used ordinary oil on the streets, which had cost them seven cents per gallon, where the haul was about two miles. They used from one to three thousand gallons per mile, making the cost of the oil run from seventy to two hundred and ten dollars per mile.

Just how long that oil will last I was not able to find out, but, I was so favorably impressed with the result as I saw it that I hope to be able to go out there again shortly, when they are going to have another of those races, and when the roads will be completed, and perhaps will be able to get all the information I want on the point.

A MEMBER: Is it petroleum they used?

MR. TILLSON: Yes.

MR. POLLOCK: Mr. White's paper refers to asphaltic oils.

MR. TILLSON: The oils of California have an asphalt base, while those of Pennsylvania have a paraffine base. I do not think, personally, that the paraffine oils will last as long as the asphaltic oils, and I hardly think that we could use it to advantage on our city streets.

We have a great many macadam roads that we could sprinkle with oil—roads that are not built up in the suburban part of the borough, and that is where I hope to be able to use it to advantage, and get good results.

From the information that I have been able to get from those people who have used oil on roads, it is necessary to have quite a lot of dust on the road, so as to form a sort of crust, and create a crude asphalt pavement.

Of course when the oil is first applied there is bound to be a certain amount that will be tracked up, and for that reason I have never heard of it being used successfully for city streets. However, next spring I expect to be able to try it, and I hope that the results will be as satisfactory as I look forward to.

MR. BARLOW: Have you ever tried it in courts?

MR. TILLSON: We have no courts in Brooklyn.

MR. BARLOW: We have plenty of them here.

MR. RUST: We hear a great deal of experiments that have been made in California, but I do not think that the same rules can apply to a country like that, as compared with the conditions we have in this part of the world.

We tried some oil upon one of our streets, and the result was that while it laid the dust effectually it was tracked into the houses. It so happened that it was laid just outside of the city hall, and for several days the smell of the oil was all over the building. It was also tracked into the different stores, and all over the carpets in houses, and finally we had to give it up.

I agree with Mr. Tillson when he says that it is not advisable to use it in city streets.

MR. HOWARD: I have had occasion to examine about eighty miles of those oil roads for some clients in Southern France, who were tired of their country roads. After studying the matter carefully I came to the conclusion that paraffine oils are unfit for oiling roads. The Texas oils and the California oils are suited for oiling certain classes of roads in the country and in suburban districts. It is not used in any place inside of a city in California so far as I know.

The use of oil is certainly a great blessing for laying the dust, there is not the slightest doubt about that, but the use of it in city streets is impracticable.

The difficulty, apart from the tracking, is that it will form an emulsion when it gets wet, and will get on the clothes and is very difficult to get off.

It was tried in Jersey, the Pennsylvania oil being used. It was not too bad till a slight rain came and mixed with it, and then we had a kind of a brown emulsion, something similar to wet meal with grease in it. The result was that the experiment had to be abandoned.

This is the result of my observation and experience. I may see fit to change my ideas on the point at any time, but for the moment I do not think that there is any use discussing oil for roads inside cities.

The question of tar roads is, of course, a different one. I advised my clients to stay by their coal tar, which was put on hot and penetrated a distance of about half an inch into the material of the road, and stays hard after it gets cold.

MR. REIMER: Some of the railroads, at least those who use stone ballasting, find that there is little trouble with dust, except at the street crossings, and there they seem to pick up a great deal of it.

One of the railroads running through our little city used oil on their crossings. It was very offensive to me personally, and I should judge that the people who lived in the neighborhood would find it so too. The reason of this is that it was constantly by them, and they would have to smell of it in their houses all the time.

I would like to know if that has been the experience elsewhere.

MR. POLLOCK: The problem is with petroleum, not with oil like liquid asphalt.

MR. EGGERS: Down in our city we have very few streets macadamized, and they are not satisfactory. We are trying the experiment of taking some of the old asphalt taken from some of the other streets and putting it over the surface of those macadam streets. We believe we will get a good result and at a cost of about twenty-five cents a square yard. We cook the old asphalt over and loosen up the surface of the street and pour on this liquid hot, then it is rolled over.

It is simply an experiment that we are carrying on to see if we cannot improve things, for, as I say, our macadam roads have proved very unsatisfactory. In the summer time the wind blows the material away, and when we get any kind of a severe storm it washes it away and we are always having trouble with them. I believe that if we kept those roads in good repair they would be the dearest roads we have in the city. I think that macadam is the most expensive roadway that you can have, if you want to keep it in good repair.

MR. BARROW: We made an experiment something on the same lines as Mr. Eggers, on an old tar macadam road, that was out of repair and we had to resurface it. We used old asphalt on it, at a cost of about forty-five cents a square yard.

MR. KENDRICK: Several years ago we tried sprinkling with crude oil, and it was a failure.

This spring we constructed a block of pavement on about a five per cent grade, in the ordinary way, except that we did not put the screenings on top, but instead we scattered about an inch of asphalt and then we applied about an inch of screenings. The pavement has been there for six months and it has a very nice appearance. We are waiting to see what the result of the experiment will be.

THE PRESIDENT: Have they not had other experiences in the South?

MR. EGGERS: What does that work cost?

MR. KENDRICKS About twenty cents per square yard additional.

MR. RANKINE: As a matter of information I might say that in the report of the Department of Agriculture for 1903 there is quite a lengthy discussion of this question of oil on roads, and anyone interested in the matter would perhaps do well to consult the report of the department.

MR. EGGERS: Would it be in order now for me to ask a question? I would like to know what the opinion of the members present is with regard to "Bitulithic" pavement. I know that there are many gentlemen present who have tried it, and I would like to know what their experience has been?

THE PRESIDENT: No doubt that is a very interesting subject, Mr. Eggers, but still it is a little outside of the paper under discussion, and I am afraid that I will have to declare it out of order, as going a little too far afield.

I do not wish to shut out any discussion, but I am sure you will agree with me that if we allowed subjects to be discussed which are not brought up by the paper that there would not be any end to it, and we would never get through our program.

MR. HAZLEHURST: I have devoted some time to the study of oiling the country roads in our county, and perhaps it would interest the meeting to know what we have been able to do.

We are particularly unfortunate in lacking good material. We have no stone in our county at all. The soil is very loamy and sandy, so that the construction of even a fairly good road is almost impossible, unless we use the only available material, which is shells. We use oyster shells on our roads, as a rule, and it makes a fairly good road, of course, apart from its blowing away with the wind and being washed away by the heavy rains.

I have given a good deal of attention to the use of the Beaumont oil, which is an asphaltic oil, and is produced in Texas. After looking into it very carefully I came to the conclusion that it was largely a question of atmospheric conditions. I did not come to this conclusion hastily by any means, but only after I had studied all the information that I could get from the Department of Agriculture and from California. When I speak of it being a question of atmospheric conditions I mean this—In California they have very little rain (some seasons they have none at all) while in our locality we have from fifty-five to sixty-five inches of rain during the year. I have not made any actual experiments on the ground, and so am not able to give you any personal experiences, apart from the fact that I came to the conclusion that it would be unwise to use oil on our ordinary roads, where there is as much rain as we have. I think our average rainfall for the year would be about sixty inches.

THE PRESIDENT: There is a paper by Mr. Stewart on "Gutters and Cross Walks for Macadam Pavements." I think this would be a good time to hear Mr. Stewart.

Mr. Stewart then read his paper as follows:

GUTTERS AND CROSS WALKS FOR MACADAM PAVEMENTS.

BY W. J. STEWART, ROCHESTER, N. Y.

Macadam pavements, as usually constructed in cities and towns, are built between curbs, and this form of construction calls for a gutter and crossings. Of course, in the country these adjuncts are not used, nor are they necessary.

On the "Model" street at the World's Fair in St. Louis some fine samples of pavement were shown without curb or gutter, the pavements being built to the turf on either side in a straight clean-cut line, a well kept lawn extending from this line to the walks.

Here was shown asphalt, bitulithic, brick and macadam, all so crowned and graded as to make a beautiful finish; but in cities and towns proper curb and gutter are necessary, and generally crossings, though in some cities the latter are omitted, as they tend to the disintegration of the pavement at these points where the more unyielding crossing causes the macadam to be cut away on either side.

Brooklyn has some miles of pavement constructed in this way, but generally it is considered desirable to have a suitable crossing at the intersecting streets, at least, and in Rochester they are so constructed, and also where the distance is great between the intersecting streets they are placed midway between such streets. Our practice has been in the past to construct the gutters and cross walks with stone on a sand foundation, and later with block stone on a concrete foundation, the stone running parallel with the curb. The crossings, with cut stone flags 18 inches wide, the joints cut on the diagonal, three courses of flagstone placed 6 inches apart, a course of flagstone filling this space and 3 feet of paving on either side of the flagging, making the crossing 11½ feet wide. This stone construction, while very satisfactory, is also very expensive, but when well grouted the gutters are smooth and stable.

A more recent construction that seems to combine all the good qualiites of the stone, while being much cheaper, is of brick, preferably the block form, on from 4 to 6 inches of concrete and thoroughly grouted with Portland cement grout mixed in the proportions of one to one.

These gutters are 3 feet in width generally, though the width will vary 2 or 3 inches, depending on the kind of brick used, the crossings being 11 feet in width.

At first the brick were placed in parallel courses with the curb, but this made a straight joint with the macadam, allowing the traffic to cut a rut along the joint and the wheels to travel along the length of this rut, tending to wear the edges and also to displace the brick in places.

Another plan was tried by placing the brick at an angle with the curb, and in order to break joints properly, the cutting of a brick in every other course. This mode of construction made a kind of tooth edge where jointing the macadam, with considerably less tendency to cut away at the joining of the two. In this way the brick wear better than when placed parallel or at right angles to the curb. This will be found to be the case in a more marked degree where the street is entirely paved with brick. The traffic will be smoother and the brick wear longer. Placing the brick gutter at right angles to the curb also requires the cutting of every other course, in order to break joints.

In any mode of construction it is always desirable to have the concrete foundation project a few inches beyond the brickwork for better support to the brick, which are liable to be pressed below grade at the outer edge by the steam roller.

A more recent construction, and one that has proved the most satisfactory of any, has been the herring bone fashion that combines all the advantages, with none of the defects, of the other plans. One of the greatest advantages is that no cutting of the brick is necessary, and the outer edge is left toothed, allowing the macadam to be pressed into the toothing by the roller, thus making a better joint between the brick and macadam, and the slightly extra work of laying in this fashion is more than offset by the fact that no cutting of the brick is required, while the joints are properly broken without effort on the part of the bricklayers, and in a uniform manner. The appearance is decidedly better.

Crossings can also be laid in this manner with decided advantage, as they are more securely bound together, and when properly grouted and traffic kept off for two weeks afterward, for a proper setting of the grout, will present a surface as true as asphalt, and depressions will never be found for the retention of water.

It is true that a well made and well kept macadam pavement generally presents a good crossing at any point, but as they are not generally well kept, and depressions retaining water are apt to be frequent in a well traveled street, the crossings are a decided advantage to pedestrians, if not to the roadway and vehicles.

THE PRESIDENT: This paper is now open for discussion. I agree with Mr. Pollock when he says that while this is a seemingly small matter, still it is really a very important one.

MR. REIMER: I have pretty nearly fifty miles of Telford macadam roads to take care of, and this question of crossings is a very interesting one to me.

Our people insist on having crossing at street intersections, and when I heard that this paper was to be presented to this meeting I was in hopes that something would be brought out which would show us how we are going to keep the roads up, or the crossings down, so that we would have an even roadway all the time.

With our fifty miles of road we find that we cannot do it—we have not discovered the way yet, unless we change the system altogether. The crossings make a nice smooth surface for the wheels, but as soon as they strike the macadam we find that they invariably grind a little bit off the edge. It is only a little at a time, it is true, but it continues, and after a short while we find that we have a slight hollow on each side of our cross walks. This hollow rapidly increases once it gets started. I hope that the discussion of this paper will bring out some means of remedying this condition.

MR. SHERRERD: I would like to ask Mr. Stewart a question. He spoke of using the herring bone form without cutting the bricks. I just wanted to know whether he would fill in the space entirely with cement?

MR. STEWART: Yes.

MR. SHERRERD: Without cutting the brick?

MR. STEWART: Yes. It is not necessary to cut the brick.

MR. SHERRERD: If you do not it leaves quite a hole?

MR. POLLOCK: I do not see the object of cutting the brick myself, in order to lay it diagonally. You would get the same serrated edge against the curb as you get along the gutter.

MR. STEWART: You get less lap all the time.

MR. POLLOCK: It seems to me that you would have the same lap at each joint. You get an angle equal to the thickness of the brick. You get a breakage of the joint.

MR. STEWART: But you get a small lap, not enough to make any difference.

MR. POLLOCK: And you would have the same lap that you would have at the edge, if you were to cut the brick.

MR. STEWART: I don't think so.

MR. POLLOCK: I understand that you simply get a little triangle equal to the thickness of the brick.

MR. TILLSON: I might say that for the last two or three years our practice has been wherever we curbed or guttered a street without pavement, or where we have laid macadam to set the curb in concrete, and put either a two or three foot gutter of vitrified brick, set in concrete, the joints being filled with cement grouting. We lay the brick parallel to the curb.

None of our macadam streets have any traffic to amount to much. They are in the residential portion of the city, and up to the present time the brick has been perfectly satisfactory.

I can plainly see, however, that in streets where there is much traffic, as in some of the streets of this city, where they use macadam, there might be some danger if you have the courses parallel to the street, so as to have a longitudinal joint, but I do not think that the plan of laying the bricks diagonally would do much good, because the joints are so small. I feel confident that the practice that we are using is about as satisfactory a method as can be adopted.

A MEMBER: I would like to ask our Secretary whether he considers concrete as good a material as brick for such work?

MR. TILLSON: We do not. We have one street in particular (and I happen to live on it) which was paved with macadam about eight years ago, and the gutters were made of concrete. I know that the job was well done. The sidewalks and the gutters and the curbs were all laid at the same time, and we have found that the concrete gutters have worn away a great deal. It is a fact that concrete gutters will wear very fast, and the result of our experience is that we will not lay any more of them, except on one or two streets where there has been some concrete already laid.

I do not believe that it is good practice to lay concrete gutters, especially on macadam. If by any chance the edges of the gutter get above the macadam, say half an inch or so, then the edge gets the wear. In any event they are not satisfactory, so far as our experience has shown us.

MR. KENDRICK: I may say, Mr. President, that in our city we have abandoned those cross walks in the residential districts. We have a great many macadam streets, and instead of the cross walk, we raise the ground slightly at the intersection of those streets, starting back about sixty feet or so.

As Mr. Hazelhurst has told you, we have very heavy rains, sometimes as much as sixty inches in a year, and we lay concrete gutters about three feet wide. This concrete we make of furnace slag. We use furnace slag for almost everything down there, because we get it for practically nothing. The concrete that we use is made of one part of cement, three parts of sand and six parts of furnace slag. We put this on six inches thick, and dish the gutters as we make them. We then spread some of this mortar over the concrete and broom it in, and divide the whole thing into nets six feet long. It is separated with a piece of tar paper every six feet, and during the five years that we have been using it we have had practically no trouble.

Of course, I admit that it would wear out on the streets where there is heavy traffic, but where we have it it has given good satisfaction. It costs us about sixty cents a square yard.

Mr. Barlow: We laid a part of Sherbrooke street, about ten years ago, with concrete macadam and a scoria block gutter about three feet wide, and we found the result very satisfactory for about five years . After that the concrete commenced to wear, and the edges of the blocks stuck up and were worn off. Otherwise it is still a very good street.

Mr. Rust: In Toronto our experience has been somewhat similar to Mr. Tillson's. We laid bricks parallel to the curb, and have had no trouble with them. Of course I am now speaking of the bricks that were laid on macadam roads in the residential district.

The President: I see that the members take a great deal of interest in what was called a seemingly unimportant subject. Personally I think it is about as valuable as any of the subjects we are likely to have brought before us for discussion, and I am pleased to see that the discussion has been so free and open.

If there are not any more remarks on this paper we will pass on to the next item, which is a paper on "Paving Materials; the Importance of Preliminary Tests," by Mr. J. W. Howard of New York.

Mr. Howard presented the following paper:

PAVEMENTS AND PAVING MATERIALS; THE IMPORTANCE OF PRELIMINARY TESTS.

BY J. W. HOWARD, CONSULTING ENGINEER ON PAVEMENTS, NEW YORK CITY.

The better the education, information and experience of an engineer or constructor, the better he is able to build for present and future needs. Paving is a brand of engineering which, like water works and other branches, demands a knowledge of the past from study, reading, correspondence, examination and experience, to enable the engineer to provide specifications, tests and inspections, and thus produce pavements for present needs and which with minimum repairs can be used by succeeding generations.

As to cost, a city has so long a life that cheap maintenance, not cheap first cost, is true economy.

The problem of what is the best pavement is a local problem for each city and for each street. It depends upon the character, traffic, grade and other elements in each case. There are streets and avenues in almost every city adapted to either gravel, macadam, Telford macadam, asphalt, bitulithic, brick, stone blocks or other pavement. Local conditions and available materials must be considered.

It is the duty and privilege of every city engineer, official or other person, who has to do with street paving, to use the recorded, valuable and accessible experience in many cities in Europe and America, in laying and maintaining pavements. They should use, or cause to be used, the well established preliminary chemical and especially physical tests of paving materials, based upon practical and concurrent experience with past pavements of all kinds. We thus avoid past failures and repeat former successes.

Pavements of many kinds have been so long in use that the accumulated experience is very great. We must read, or possibly travel a little, to obtain it. No person, whether city employe or contractor, should experiment at the expense of a city. The long experience of the world with the following pavements is of interest. Scientific principles, definite tests and methods of construction have been deduced.

The pavements of the principal streets of ancient Rome and her leading colonial cities, although with worn surfaces, were a visible evidence to me, when I inspected some of them, that a solid foundation is a first requirement.

The French engineers, about 1770, provided a well drained sub-soil and demonstrated that a water-free bed is esential to lasting success for pavement foundation. It then withstands settlement from water and disturbance from freezing. It is thus possible to use thinner and cheaper foundations.

The Scotch engineer, MacAdam, established his system about the beginning of the last century, and made road surfaces of crushed stone, which, when properly selected and compacted, would bind together. All civilized nations soon adopted his methods. The French established definite methods of preliminary testing crushed stone for proposed use in macadam. Other governments, including ours, are following.

The English engineer, Telford, about a century ago, improved on MacAdams' method, by introducing under the crushed stone a foundation of large stone. This acts as a combined drain and a foundation for the macadam surface.

The study and administration of paving is being placed more in the hands of engineers and, like other structures, with more economic and better results. The last 112 years has seen the development of stone block pavements, until we have the modern, uniform and well cut granite or equivalent block pavement with joints closed with waterproof filler, all on a solid concrete or equivalent foundation. Too many granite and other stone block pavements do not even approximate the model work found in Washington, D. C., and a very few other cities of the United States and Europe. This is largely due to the lack of knowledge of the best kinds of stone block pavements and how to secure them by preliminary tests and requirements.

Asphalt pavement was successful in 1854, on Begere St., Paris, France. It steadily spread to London and important European cities, where it is still maintained in constant good order, on the principle that "a stich in time saves nine." The celebrated French engineer, Leon Malo, who paved the street mentioned, is the father of asphalt pavements. It has been my privilege to be his guest in France and see his methods of testing and using asphalt paving materials. The asphalt pavements of Europe, with a very few late exceptions, are natural bituminous limestone. It was in 1871, in Newark, N. J., and finally in 1876 in Washington, D. C., that the American artificial, asphalt mixture pavements took their start, being composed of about 90 per cent of sand, etc., cemented together with about 10 per cent of asphalt-cement, (asphaltum and bituminous flux). These artificial mixture pavements depend for success, possibly more than any other kind of pavement, upon extensive preliminary chemical and physical tests of their component materials, combined with experience. Tests of asphalt, sand and other parts of asphalt pavement mixtures, full technical specifications and inspection of construction, are more necessary than ever, because there are now many good competing asphalts. These tests must not be made nor indicated, as is too often the case, by any man in the regular employ or controlled by any one asphalt interest. The tendency is to use purer and better asphalts, especially those not seriously affected by water. I have had occasion during the past two years to examine sixteen good asphalts, from as many independent sources. Some of the principal tests of asphalts and bituminous composition pavements are as follows: The asphaltum, flux, asphalt-cement, bitumen, etc., for purity, nature and quality, cementing power, ductility, flow, penetration, stability by evaporation or distillation, etc. The sand and other substances present or proposed for the mixture must also be carefully tested, all by standard laboratory tests, based upon experience with testing the materials, composition, etc., while laying or examining past and especially sucessful asphalt pavements.

Wood pavements, used under constant conditions of moist climate, uniform traffic and constant repairs, have been in use in London for more than forty years. Of course many of the wood blocks are often replaced, and all of them every three to seven years. Wood pavements, as a whole, especially in our wet and then dry American climate, have been failures. Nevertheless, there are a few streets of a few cities where wood pavement, properly laid and maintained, will be a luxury worth its cost. It is wise to know the history and necessary to use the preliminary tests of wood paving materials and to have full specifications, to insure even approximate good results.

The rise of brick pavements began by small experiments, between 1870 and 1885. Their increase during the past fifteen years has been large. They are used a little in Holland and England. There are now about 168 makers of paving bricks in the United States. They produce many sizes and many qualities. Most of them are suited to only the lightest traffic. A score of makes of shale and a half dozen fire clay bricks will sustain medium traffic. There are a few good shale bricks, however, which will bear fairly heavy traffic and which are suited to some streets in many cities.

Brick pavements are a class which demands strict preliminary tests to secure sure results. Brand will not do it. Even a brand varies at times. The principal tests are abrasion, cross breaking, water absorption, density, hardness, crushing, also tests for free lime, potash, etc., presence of cracks, uniformity of shape, material, etc. Paving bricks which pass definite standards and methods of tests will make good pavements for certain streets in many cities. I have lately tested forty-two makes, and several passed safe the requirements.

Another class of pavement is what is called tar-macadam. It is being experimented with in a few English towns and in some Canadian and United States cities with light traffic. No definite mixture of tar nor quality of tar and stone or gravel are used. Each place or company is trying its own mixture, sometimes calling it tar, bituminous, or even asphalt macadam, for various proper local or for commercial motives.

A special pavement, called bitulithic, made of selected and prepared tar products or bituminous cement combined with graded, crushed stone, etc., began its rapid rise five years ago, being the result of examination of past experience, laboratory research and experiments. The theory and practice of bitulithic pavement is one of dependance for its good results upon preliminary tests of materials and predetermination of mixtures, combined with rigid inspection of work in progress.

Without discussing granite and other pavements, not enumerated, sufficient has been said to indicate the importance of using standard, scientific, chemical and physical tests, and examination of all paving materials previous to and during their use in pavements. The custom of certain cities relying on pavement guarantees and bondsmen is a bad one. No such method is in European cities, nor is it used for public buildings, bridges, water works, etc., in the United States. A street needs a good pavement, not a good bond alone.

A pavement laboratory, combined with good specifications and inspection, not only insures good results, but saves a city vastly more than the annual cost of its laboratory. While my testing plant and laboratory is at the disposal of all who send paving materials, it is a greater pleasure to freely help cities prepare specifications, state the tests and establish their own testing laboratories to their permanent advantage.

Mr. Eggers: Would it be in order to ask now the question which I put a few minutes ago?

I want to ask this now, not only of Mr. Howard, but of the gentlemen who represent the different states and cities.

About a year and a half ago we laid four streets with bitulithic pavement. I, as one of the commissioners, advocated very strongly that we should get a sample of it in our city, as we spend three or four or five hundred thousand dollars every year for pavements. We were all very much interested in getting a noiseless pavement.

Well, the four streets were laid, and so far those four streets have proved satisfactory to me, and I believe to the other commissioners. The company then tried to get a lot of other streets to pave, which I did not approve of, and which the other members of the commission did not approve of, because we are elected directly by the people, and are held responsible by the city, and it is therefore very essential for us to know what we are doing, and we are very anxious to learn whether this pavement will last.

So far the pavement is wearing pretty well. We have no complaint that it does not wear. It is noiseless, and is not very dusty. It is merely a question of how long it will last.

It cost us two dollars and twenty-five cents a square yard, but we have no kick on that. As you all know, it is a patent pavement, and I might tell you that the majority of the property owners on the street have given their consent and want the pavement.

Of course you cannot always go by that, because I found out that they did not always use an honest way of getting those subscribers. The asphalt companies do the same thing. They go and see the people and get their consent, and then come to the board and say that the people want that pavement. I never thought that a fair way of doing it, but I am not an enemy of that pavement by any means.

In regard to the bitulithic, I want to know just how it is going to last, and what satisfaction it is giving before I vote to lay another yard of it. I want to know if it will wear.

I would like to have the benefit of the experience of the gentlemen present, because I believe that the pavement has been laid in different sections of our country, and in Canada, during the past five or six years, and I would be very much interested in learning what the result of the experiment has been.

Mr. Carpenter: As representing the City of Pawtucket, in the little State of Rhode Island, I feel called upon to answer Mr. Egger's question, for the reason that the first piece of bitulithic pavement ever laid in the United States, or, in fact, ever laid anywhere in the world, was laid in the city from which I hail. I also want to say here and now, as was suggested in the question, that it was not laid because the abbuttors asked to have it done, but because the officials of Pawtucket wanted to have it. They were looking for what appeared to them to be a good thing. They had in the past experimented with coal tar—experimenting in a crude sort of way, by turning it into crushed stone hills, to prevent the washing out by rains and the kicking up by horses feet, and they had met with considerable success. It was an improvement in the binding of the stone together.

So, after noticing the bitulithic pavement, we searched for the people who were making it, and then tried to find out what it was, and that was the way the first piece of bitulithic pavement came to be laid.

That piece of pavement is now entering upon its fifth year. Some of it was placed on a 12 per cent grade, other pieces upon a 4 per cent grade, and others on a 7 per cent grade. The street is narrow, only 33 feet in width, and 21 feet between the curbs.

This piece of pavement is proving entirely satisfactory, and today I cannot see that it is any different from the day it was put down.

We also laid another piece nearer to the center of the city, on a 40 foot street, 24 feet between the curbs, and of a finer surface than that on the heavy grade. We did this purposely. That street appears to-day to be in as good condition as when it was first laid.

A year ago last summer we also laid two long streets—upwards of thirteen thousand yards in each place—and on streets in which there was a trolley line. One of the streets is 40 feet in width, with the ordinary 8 foot sidewalks, 24 feet between the curb stones, and the standard trolley line in the center.

All that whole street paving is smooth. The teams, of course, will not travel in the center of the road, the part occupied by the tracks, but will take to either side, and that pavement is wearing well and is in good condition to-day.

As far as my observation has extended the wearing features of the bitulithic pavement appeal to me as being very satisfactory, and I have seen the pavement in a number of cities outside of my own.

By the way, I ought to have told you that the pavement I was speaking of, in Pawtucket, has had no repairs, and it is not in need of any now.

In one instance it became necessary to cut an opening in the street to fix a water main. A square hole was cut in the pavement and the piece was taken out in one block, and after that the excavation made and the pipe caulked. When the hole was filled the piece of pavement was put back in its place, and it is there to-day in as good shape as the rest of the pavement, with only the mark of the cutting around the square. There is no depression, no elevation, and there has been no working away of the edges, because of the cut.

Another thing that appeals to me as being of some consequence, and to show something of the nature of the pavement, is this: There appears to be no necessity of putting a heading course where the bitulithic ends and the macadam begins. It has not been done with us, and there has not been any breaking away.

I rise to offer those few remarks simply for the reason that Mr. Eggers has asked for the experience of those present, and for information regarding cities which have used the bitulithic, and inasmuch as I represent the city which has happened to have the longest experience with this particular pavement, and also, as somebody has been kind enough to say, that "Pawtucket, Rhode Island, is the mecca of all enterprising engineers."

Mr. Kendrick: We began laying this bitulithic pavement about two years ago, and we have so far constructed about a hundred thousand square yards of it, and have about fifty thousand under contract.

Before laying the pavement we examined it in Nashville, Tenn., and many other places. In Nashville it has been down nearly four years, and so far as I have been able to see it looks better now than it did when it was laid down.

We began in the center of our city and laid the pavement on the streets with double trolley lines, and we have noticed just this one trouble with it, and it is the same as you would experience with asphalt, there is some little trouble along the rails. We have recently adopted the plan of laying vitrified brick between the rails and for 18 inches outside of them, and the rest of the street is paved with bitulithic. The grades of our streets are from practically level to about 7 per cent.

We have three classes of this pavement, one which we lay upon old macadam streets, and for this we pay a dollar and sixty-five cents a square yard, with a ten year guarantee. We have another class which we lay upon concrete foundations—six inches of concrete—and we have a third class that we lay upon six inches of broken stone. We pay a dollar and ninety cents a square yard for either of the two latter, both with a ten year guarantee.

We use furnace slag for the first six inches, and put two inches of broken stone on that. The result has been that we have had no complaints at all on the 7 per cent grade from the horses slipping or anything of the kind, and everything seems to be lovely.

Mr. Rust: Up to the present time the Warren people have laid about fifty thousand yards of their bitulithic pavement in Toronto. I think the first piece was laid about three years ago, and it is still in excellent condition, and the residents upon the different streets where it has been laid appear to be very well satisfied. It is not as slippery as asphalt, nor as noisy.

We have one street laid with this pavement where there is a trolley line, but that was only laid last year.

The prices that we have been paying are about two dollars and twenty-five cents a square yard, with a ten year guarantee.

MR. EGGERS: We have one street where there is a double trolley line, and the trolley company has laid granite blocks inside of their rails, and along outside. It seems that the pavement wears very well, so far as we have been able to see. It does not break up like asphalt, or like the bitulithic would if there was no stone along the tracks.

MR. RUST: I probably should have mentioned that we have laid granite blocks along the rails.

I would like to ask Mr. Kendrick the manner of construction where the pavement was not so successful close to the rail. Were they heavy rails or light ones?

MR. KENDRICK: Nine inch girder rails—grooved rails.

MR. RUST: Laid on concrete?.

MR. KENDRICK: Yes. This furnace slag that I spoke about is not worth much. It is free for the cartage, and we have all we want of it. It has another advantage, in a certain sense, and that is that it does not require crushing. It comes out just the right size.

I would like to mention that in laying out underground heating system we have had to take up blocks of it, and when they are put back it takes a very close observation to find out where the patches were put in. It is true that it is very difficult to take up, and we had to use iron tools to cut it right through. It is harder to take up than concrete.

MR. RUST: May I ask Major Howard if I am to understand that brick makes a poor pavement?

MAJOR HOWARD: While some are excellent, as a general class it is not a good pavement, especially if we consider the many makes of poor paving brick. Of about 168 makes, I have examined in past years, only about forty are worth considering for paving purposes. About a dozen of these makes when properly laid on a concrete foundation with the joints of the bricks crowded, with suitable grout with provision for longitudinal and transverse expansion joints, it is possible to produce excellent brick pavements for special streets in almost every city, especially where there is no objection to the noise of traffic. Any bricks which will pass the severe standard tests, which I apply in my power testing plant for paving materials, including brick, will be reliable for brick pavements. Among tests made of a large number of bricks several showed high tests. I can mention one, not by name, for that would not be proper. It showed the following record. Size, including projections or lugs on its side, 8.63x3.57x4 inches; weight, 9.6 lbs.; corners rounded; brick side cut, then repressed; shape uniform; material high grade shale; color chocolate red; interior mass homogeneous; no cracks nor voids; annealed or fused to toughness without excessive brittleness. The standard rattler and other tests gave the following averages, with slight variations of maximum or minimum of the twenty-one samples of this make tested: Abrasion, 9.7%, cross break modulus 3,581 lbs. per sq. inch; absorption of water 1.45% of dried weight, density compared with water 2.37; hardness compared with diamond 70%; crushing 9,823 lbs. per sq. inch. Chemical analysis showed no free lime, potash, soda. There are a few makes of bricks which approximate closely the above. They are found among shale, but not among fire clay paving brick, which is more friable, brittle and porous than the best makes of shale brick, due to the inherent natures of shale and fire clay.

THE PRESIDENT: The next item on our program is the reports of the committees. In the first place we will hear the report of the Nominating Committee, if they are prepared to present their report. Mr. Sherrerd was appointed chairman of this committee, I think.

MR. SHERRERD: We are not prepared to present our report yet. We desire to have an officer who will be from the place where we hold our next meeting, and perhaps the Committee on the Place of Next Meeting would present their report first, and then we will be prepared to present ours, as soon as we know where the meeting is to be held.

THE PRESIDENT: I understand that the Committee on the Place of Meeting are not prepared to present any report as yet. In the meantime I think we might proceed with the reading of the papers we have.

The next paper on our program is by Mr. B. E. Briggs, city engineer, Erie, Pa., on "The Cost of Collection and Disposal of Garbage." Mr. Briggs is not here at the moment to read it personally, but I would ask our Secretary to read it for him.

Mr. Briggs' paper was as follows:

COST OF COLLECTION AND DISPOSAL OF GARBAGE.

BY B. E. BRIGGS, CITY ENGINEER, ERIE, PA.

We find that it has been the practice of the Committee on Garbage Disposal to make the introduction of their report in the form of an apology, and as human nature is prone to follow beaten paths, we will fall in line with the statement that this important work has been placed in wholly incompetent hands—that is, so far as the chairman is concerned—without experience or knowledge sufficient for a working basis.

Letters of inquiry were mailed to a large number of cities, with a view to gathering data for this report, but comparatively few replies were received. It seems that the practice of collecting information and expert opinions by means of "circular letters" has grown to such an extent that "we have been questioned to death," as one party expressed himself in his reply to our inquiry.

However, a number of queries fell into the hands of a very accommodating and courteous officials, who furnished us with some valuable data from which we make the following deductions, in which we have not considered the cost of plants, maintenance, nor interest on the investment where the city owns the property:

In several cities, such as Terre Haute, Ind., and Salt Lake City, Utah, of from 40,000 to 60,000 population, the garbage is collected and cremated by city employes. In the former city they collect, haul three miles and burn about 3,170 tons of garbage and refuse annually, at $1.86 per ton, amounting to $6,000, or 158 pounds per capita, for 15 cents per annum; and in the latter city the haul is two miles, for 3,720 tons of garbage, at $2.60 per ton, $9,672 total, or 133 pounds per capita for 17 cents.

Atlantic City, with its varying population, which is estimated at 40,000 in winter and 300,000 in summer, and Buffalo with its 360,000 of population, each contract with private concerns to collect and dispose of their garbage. Atlantic City's contract is divided so that they pay annually $19,500, or 50 cents per ton for collection, with an average haul of one and one half miles, and $24,800, or about 64 cents per ton for disposal, making a total of $1.14 for both collection and disposal. Buffalo pays $2.19 per ton, with a haul of three miles, for 31,000 tons, which is equivalent to 172 pounds per capita for 19 cents per annum.

In Milwaukee the employes of the health department collect about 36,000 tons of "kitchen offal" annually, at a cost of $67,082, or $1.86 per ton. Transportation to the destruction plant on an island and the cost of operating the plant amounts to $50,286, or $1.40 per ton, making a total of $3.26 per ton, and an annual sum of $117,368, or 248 pounds per capita, for 40 cents.

Chicago also collects her garbage, which includes "stove sweepings" paper, etc., and carts it an average distance of three and one-half miles to the outskirts of the city, where it is disposed of by dumping into "clay holes." It amounts to about 775,000 tons annually, of all classes of refuse, at 86 cents per ton, making a total of $666,500, or 912 pounds per capita, for 39 cents.

The only information concerning a revenue derived from garbage came from the New England cities, of which we mention Lowell, Mass., with a population of 100,000, where the board of health controls a force of men and teams that belong to the city, that collect garbage under the head of swill, ashes, paper, and market and hospital refuse. The annual report of the board for the year 1904 shows that it cost, aside from maintenance, which was small, for collecting ashes or rubbish, $10,715; for swill and refuse, $8,325, and for cremating the refuse, $993, or a total of $9,318. The same report shows that they sold swill to farmers to the amount of $5,555, leaving a net total expense for garbage of $3,763, or 4 cents per capita. The quantity of garbage cannot be given, as the report lists the amount as 4,352 loads of swill, 303 tons of refuse, numerous dead animals, etc.

It will be noticed that the Chicago rate is the lowest, although "stove sweepings" and papers are collected as garbage, which fact probably accounts for the large amount (912 pounds) per capita. As the garbage is not destroyed, that rate of 86 cents is for collection and cartage only, as against 50 cents in Atlantic City and $1.86 in Milwaukee for the same work, except the length of haul. A comparison of the total rate per ton in the cities mentioned above is as follows:

	Per Ton.		Per Annum.
Buffalo, by contract	$2.19	172 lbs. per capita for	19 cents
Atlantic City, by contract	1.14	172 lbs. per capita for	19 cents
Milwaukee, by city	3.26	248 lbs. per capita for	40 cents
St. Louis, by city	2.80	160 lbs. per capita for	23 cents
Salt Lake City, by city	2.60	133 lbs. per capita for	17 cents
Terre Haute, by city	1.86	158 lbs. per capita for	15 cents
Chicago, by city	.86	912 lbs. per capita for	39 cents

The few cities mentioned above were selected as an average of their class, from the data at hand, in order to give a condensed statement.

We found some interesting information in a statistical paper prepared by Messrs. Winslow and Hanson, on "Garbage Disposal," published in the Proceedings of the American Health Association for 1903. These gentlemen receive reports from 155 cities of over 25,000 population. We quote the following extracts from their paper:

"Out of 146 municipalities, 111 report more or less complete separation of waste materials, the garbage in particular being commonly kept distinct from ashes and combustible wastes. * * * With regard to ultimate disposal, almost all the cities report that ashes are dumped on land, or used for filling, while in a few cases they are dumped in whole or in part into the nearest body of water. * * * The larger communities might, however, study with advantage, the utilization plants for some time in operation in New York and Boston, where the dry refuse, other than ashes, is sorted over as it passes along a moving platform, so that paper, metal, and any other objects of value are recovered, and only the worthless is burned. * * * The methods in use for the disposal of garbage vary more widely, and their relative importance is indicated in the following:

"44 cities dump on land.
9 cities burn in dump.
14 cities dump in water.
18 cities plough in or use as fertilizer.
41 cities feed to live stock.
27 cities cremate.
19 cities reduce.
11 cities irregular disposal by private parties."

THE PRESIDENT: I think it would be as well for us to have all the papers on this subject read first, and then if there is any discussion they can all be taken en bloc and dealt with in that way.

With the consent of the members I will now call upon Mr. Howard G. Bayles of New York to read his paper on "The Incineration and Cremation of Municipal Waste."

Mr. Bayles then read the following paper, as requested:

INCINERATION AND CREMATION OF MUNICIPAL WASTE.

BY HOWARD G. BAYLES, CONSULTING ENGINEER, NEW YORK.

There are four steps in the advance of progress in municipal final disposition. These are,—first, to throw waste into private back yards, as far from the house as possible. As the population becomes more dense, the tendency is to throw all waste into what might be called "the back yard of the city," or its outlying and unimproved margins.

The third step is made when it becomes too expensive to haul all classes of waste far enough to prevent the putrescible parts of it from making a nuisance. Then comes separation, dumping the less objectionable waste, and the reduction or cremation of the garbage and offal, usually at heavy expense. The final step along the line of sanitary and economical final disposition is to burn all classes of waste.

This conclusion became fixed in my mind in studying New York's conditions and requirements. I turned to other cities for proof.

To discuss reduction at any length would be to waste your time. The only reduction works that I have recently visited were in Columbus, Ohio. This single example is enough.

The Columbus collection of garbage and dead animals in 1902 was 12,640 tons. The subsidy paid by the city for collection and treatment, under a ten-year contract, was $15,800, or $1.25 per ton. The company claims to have received that year from the sale of by-products about $30,000, or $2.37 per ton. They also say that their net loss was $5,000, or 40 cents per ton. The total of these figures would make the cost for collection and reduction a trifle over $4.00 per ton. Of this, probably $1.75 represents the cost of collection, as the cart haul is short, and the balance, or $2.25, the cost to the company of operating the plant and paying salaries. Aside from its expense, this plant is a nuisance of the most pronounced order. To multiply examples would be useless. Reduction has everywhere proved an expensive nuisance. That is why I ranked it with the cremation of pure garbage as the third step toward ideal final disposition.

The word "Cremation," by the way, I shall use as applying to the destruction by heat of pure animal and vegetable waste.

I shall speak of "Incineration," when I refer to the burning of mixed refuse.

Milwaukee owns and operates a brick garbage crematory, located on Jones Island, in Lake Michigan. The location very much increases the cost of collection, but was forced on the city by a public prejudice so strong that no other site was possible. Judging only from personal observation, I should say that the prejudice had been amply justified. The system of dumping all garbage first into large open drainage tanks from which it is shovelled by hand into the furnace, allows the odors to escape freely. Besides creating a great nuisance, this plant is extremely expensive to run. With a capacity of about 100 tons, from 65 to 85 men are employed in and about the crematory. The cost for operation and maintenance is about $1.87 per ton. Even at this high cost, the work is not thorough, and numerous complaints have been made to the board of health concerning the partly burned and still rotting material dumped with ashes on the lake shore.

Muncie, Indiana, has had for some years a crematory, burning natural gas. The fuel is so cheap, while it lasts, that expenses appear very low. As long as the gas was plentiful, the cost for labor and fuel, burning about 12 tons a day, was 67 cents a ton. The crematory was built by a man who knew nothing of garbage cremation, but had worked in a steel mill. He therefore did what he knew, and built simply a Siemen's regenerating open-hearth furnace. It would be too costly with any other fuel, and the approaching exhaustion of the gas has made it necessary to find another form of furnace. The selection made by a delegation from the city council, after carefully inspecting a number of municipal plants, was the type of steel incinerator used in Minneapolis.

Hearing of the approaching test of the new incinerator at Muncie, I decided to be present, and was paid the compliment of being asked to keep the exact tally of weights, and make a report on the whole test run. The contract called for a furnace that should burn in 24 hours

24 tons of kitchen garbage,
12 tons of combustible refuse,
4 tons of night-soil,

at a cost for labor and fuel not to exceed 50 cents per ton.

At the end of the test there had been burned:

28 tons of garbage and dead animals,
9¼ tons of combustible refuse,
4 tons of night-soil.

The combustible refuse was of a very poor grade, containing a considerable quantity of manure, and the proportion actually burned was less than one-third the garbage, instead of one-half as agreed, thus burning a more difficult class of waste than was necessary.

The cost for labor and fuel properly chargeable to regular operation was $8.05, or about 20 cents per ton.

The most expensive furnace I have visited is on Staten Island, or, officially, the Borough of Richmond, New York City. Here the amount burned in 1904 was only 1900 tons, and the cost for fuel, labor and repairs was $2.88 per ton; 1903 was somewhat lower, only $2.44 a ton, but the first six months of 1905 show a cost of $3.47. The garbage burned in this crematory has a considerable admixture of paper and rubbish. The ash is from 25 to 30 per cent. of the weight of the material burned, which means incomplete cremation.

The Atlantic City crematory, which was wrecked by a storm some years ago, was of another of the brick types. At the time of my visit, exact figures as to its cost of operation were not available. My estimate, from such data as I could get, was that it cost $1.70 per ton through the year.

Mr. J. Fetherston, Deputy Commissioner of Street Cleaning for the Borough of Richmond, New York City, kept a careful record of a week's run one summer and found a cost of $1.48½ per ton.

In Bridgeport, Conn., the experience with a brick crematory was unsatisfactory, and a reversion has been made to what they consider an improved form of reduction.

The now abandoned crematory cost $15,000 to erect and about $500 a year to keep in repair. The expense for labor, fuel and repairs was $1.17

per ton. The fire-brick bars that form the grate of the middle chamber had to be replaced, a few at a time, about once in the year. This crematory belongs to a well known type, and merits a brief description.

There are three chambers, one above another. The top, or drying chamber, supports garbage on a brick arch which is heated from below. Material is delivered to the central chamber from time to time by raising the metal bells that cover the dumping holes and poking the garbage down by hand.

The central chamber supports garbage on fire-clay grate bars. Heat is supplied by a coal fire at one end, the gases from which pass over the garbage on their way to the stack. From this chamber garbage is again poked by hand to the lowest, which has a solid hearth. This chamber is also heated by a coal fire at one end, and forms both a secondary combustion chamber and the ash pit. A third coal fire is placed at the entrance to the stock, to consume any odors from drying garbage.

This crematory embodies three of the worst features of design possible in a garbage furnace.

(1) The floor of the top chamber is a fire-brick arch, intensely heated from below and irregularly cooled from above. No brick arch ever made can stand such treatment very long, and the engineer in charge must watch it carefully in order to rebuild it before it caves in.

(2) The fire-brick grate bars are special pieces and costly. Even with normally careful operation, they are frequently chilled from red heat to comparative coolness, and, in consequence, often break. They are, moreover, so situated as to be extremely vulnerable to the blows and disturbances of the heavy pokers which the firemen must use.

(3) The principle of the burning is wrong, as it is done from the top down, and the first material burned blankets what is unburned. To counteract this tendency, a large force of stokers is necessary, in order to keep the material constantly turned over.

In Trenton, N. J., there is another crematory of the same type as the one in Bridgeport, but somewhat different design. In this furnace there are only two chambers, the two upper ones described above being merged, and a grate of iron bars being substituted for those of fire-brick. The original cast iron grate bars lasted very badly, and were replaced by 80-pound rail sections. These seem to have lasted better.

As this was a private plant operated under contract with the city, and the contractor had died, no figures could be had as to its cost of operation. The only light on the subject is furnished by the fact that at the expiration of the contract the city was in doubt whether to buy the existing crematory or build an incinerator for mixed refuse of the type used in Lancaster, Pa.* This latter plant I have not visited, but I have the departmental reports for some years back, and at the time the choice in Trenton was made, the cost in Lancaster for incineration was $2.10 per ton. As this presumably promised an economy, the Lancaster plant was decided on. That this economy has been more than realized in Trenton, seems apparent from the figures given me, which showed a cost for labor, fuel and repairs of only 50 cents a ton. What is not so apparent is why the same work can be done with the same furnace in Trenton at one-fourth the cost in Lancaster. This discrepancy would argue a misunderstanding somewhere.

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*N. B.—Since this paper was presented, I have learned that the Lancaster plant has also been abandoned.—H. G. B.

The incinerators of Trenton and Lancaster are of a type quite different from any I have so far described.

The unit cell, of which Trenton has two, is about 6 feet wide, 5 feet high and 10 feet long. The bottom, which is about 3 feet above the floor level, is formed by an iron grating. Under the 4 feet nearest the front is an ash pit. Under the rear part is a shallow pan to catch excess moisture, which is later evaporated by the heat above. The sides and top are of brick arch construction, and at the time of my visit were much in need of repair, as the bricks were badly burned out. Refuse is put into the cell through a circular hopper in the top, opening from the upper or dumping floor, and closed by a heavy cast iron lid.

As the gases of combustion leave the cell, they pass over a coal-burning grate which acts as a fume consumer, then to the stack. In the stack is placed a grate to intercept any particles of paper carried out of the furnace. That this does not quickly clog the draught is a surprise to me.

The fire is started by using paper, wood and coal on the forward part of the grate which is over the ash pit. When this is burning strongly, the cell is filled with refuse. This is stirred and pulled about both through the top hopper and the front doors. Every two to four hours the firemen have to let the material in the cell burn out, and clean it completely. A new fire is then made. The presence of unburned pieces of melon rinds, corn cobs, potatoes and other less combustible waste in the ashes would seem to indicate that the combustion is not always complete.

Yonkers, N. Y., has a small incinerator, burning from ten to twenty-five tons per day, according to the season. The cost for labor, fuel and repairs through the year is about 61 cents per ton.

The furnace is of brick, divided into an upper and a lower chamber by a grate of cast iron bars. Each bar has three longitudinal webs, so that turning it over dumps refuse from the grate to the hearth. Two coal fires supply heat. Gases from the first fire pass over the material on the grate, join the gases from the second fire, which is at the other end of the furnace, and return below the grate to the stack.

In two of the cities I visited I found results so radically different from those usual in cities having brick furnaces that the accuracy of my figures has been several times questioned by those whose experience led them to consider that $1 a ton was a good figure, and 50 cents almost the unattainable ideal.

In Minneapolis, Minn., an all-steel incinerator was erected about four years ago, the first of its type, and its completion marked the beginning of a new era in municipal final disposition. Since it was built it has never been idle a day for repairs, and less than $20 has been spent on keeping it in perfect order.

For the year 1904 the collections were 19,079 tons, or an average of 61.5 tons a day. The costs chargeable against the plant were $7,370. The cost of incineration per ton of mixed refuse was 38.6 cents.

Dr. P. M. Hall, the health commissioner, assured me that the cost would be materially lower for this year, probably about 31 cents, as suitable wood fuel had been arranged for at lower cost, and some unnecessary charges had been cut down by a change in the department. Dr. Hall said that they were so satisfied with this furnace that next year a similar plant will be erected at the opposite end of the city, to meet the needs of the growing population.

The Minneapolis incinerating plant consists of two fifty-ton furnaces, using a common stack. The furnace walls are of steel, having a 4 inch water circulating space, and stay-bolted for stiffness. The top, or crown, is a steam and water space 24 inches high, having an open circulation with the sides. From the front to the back wall, and a few inches below the crown, extends a 6 inch wrought iron header. The upper grate, which has an end view like an inverted V, is formed of 1½ inch extra heavy wrought iron pipes, placed about 10 inches between centers. These extend from the header to the lower part of each side wall, and form practically a water-tube boiler.

The lower grate is of cast iron, flat, and about 8 feet below the crown. The combustible refuse is dumped direct to the lower grate through a hopper outside the furnace, and opening into the front end below the upper grate. The upper grate receives garbage, offal and dead animals and the less readily combustible classes of waste. This wet stuff is held over the fire and dries out, and is gradually worked down to the lower grate with pokers. Auxiliary fuel is used on the lower grate, in the form of pine edgings and other light sawmill scrap, of which one to one and one-half cords per day are burned. A smoke and fume consumer was originally put in the lower part of the stack, but was removed, as it was found to be an unnecessary precaution.

Below the lower grate is an ash and evaporating pan. This catches and holds any excess moisture that drains from very wet garbage. The pan is of steel, with a double bottom, amply stay-bolted. As soon as the furnace gets up pressure, which happens soon after lighting, steam is turned into the false bottom of the pan, and any liquids that have drained into it are evaporated. The vapor is drawn by the draught through the lower grate, any odors it may carry being destroyed by the heat of the fire.

The gases of combustion from the lower grate have to pass through the material on the upper grate, drying and burning it, on their way to the stack. The vapor issuing from the stack is white and odorless. I am told that no complaints have been made of nuisance maintained by the plant.

Atlanta, Ga., stands at the top of the list for efficient and economical final disposition in this country, and, I believe, in the world. Their incinerator is of the same type as the Minneapolis plant, but it was built three and one-half years later, and embodies the improvements dictated by experience. This plant has a capacity of 200 tons in twenty-four hours, and consists of two furnaces using a common stack. The furnace walls are of steel, lined with fire brick. As these sides are always protected by relatively cool garbage, there is no danger of the bricks burning out for many years. The crown is of steel plate 18 inches high and liberally stay-bolted. The upper grate bars are joined directly to the crown and connect it with the headers that extend along the lower part of each side of the furnace. The downward circulation of water is provided for by four 8 inch vertical wrought iron pipes, that extend from the corners of the crown to the floor, having T couplings with the headers. These vertical pipes also serve to keep the weight of the crown from the side walls.

There are seven hoppers, all opening from the upper floor, to receive different classes of waste. Four deliver direct to the upper grate. Into these mixed refuse and moderately dry garbage are dumped. One, at the front, delivers dry combustible rubbish direct to the lower grate. Two are built externally at the sides of the furnace, and in these very wet garbage is held and allowed to drain its moisture into the evaporating pan before delivering the solid material to the upper grate. The dumping is straight from the carts into the hoppers, and there is no handling of waste. The fire is hottest on the lower grate, where dry material is constantly burning. The gases of combustion pass through the material on the upper grate, and through a combustion chamber filled with brick checker work. They then pass through two horizontal brick lined flues about 8 feet long and are deflected downward from a height of about 10 feet to nearly the floor level. Here the gases strike the surface of a water tank, placed there to detain any particles of solid matter carried out of the furnace. They then pass between two coal fires which act as fume consumers. The gases then pass over one baffle wall and under a second, again getting a downward velocity and striking a second water tank. In the lower edge of the last baffle wall is a pipe which projects a spray of steam downward. This steam carries into the water tank any solid particles not previously caught. The gases then enter the stack, which is 200 feet high and 7 feet inside diameter.

The material burned is mixed refuse, that is, kitchen garbage, rubbish, boxes, barrels, and occasionally a little manure. The bulk of the manure, the night soil, the street sweepings and ashes are not burned, but are carted out of the city.

Up to the first of July no fuel other than the coal in the fume cremator was used, the waste material furnishing all the heat necessary for its own combustion. During July it was found necessary to use cordwood on the lower grate, about two and one-half cords per day. This condition, which extended decreasingly through August, was due to the melon season.

During the months that no fuel was necessary in the furnace the cost of operation was about 14 cents per ton of refuse consumed. During July it was 30 cents, and for August it was not expected to average over 20 cents. This would make the average for the year only 16 cents per ton. The repair item is negligible. The only thing about the plant that has so far needed attention has been the concrete floor that is immediately over the furnace. There seems to be no other part of the furnace that could wear out or give way, owing to the care taken in adapting every part to its function.

Atlanta expects to duplicate this incinerator in another part of the city within a year.

But before the erection of this plant several brick crematories were tried without success. Two burned up and caved in and were not rebuilt. A third was run for a time and abandoned. The first two were designed and erected by a local company. The third was of the same type as those abandoned in Bridgeport and Trenton. I could not get accurate data as to their costs of operation, but they were evidently unsatisfactory.

A comparison of the record of the present Atlanta incinerator with those of the plants abroad would seem of interest. We must not allow ourselves, however, to be deceived by simply changing shillings and pence to American money. We must take into account the relative cost of labor if we would see how English incineration practice compares with our best attainments. Even with this correction, it is impossible to say that we have the figure for which a particular furnace would do Atlanta's work. The English use much less fruit than the Americans, and are less extravagant and wasteful. Their mixed refuse has a lower proportion of vegetable waste, and is therefore dryer. There is no house separation, and ashes carrying about 30% of good coal are collected with the refuse. This mixture of ashes should make the waste easier to burn and less likely to pack in the furnace. Assuming, however, that the refuse has the same composition, we can reduce the cost of labor to our standards and get an approximate idea as to relative efficiencies. Charges and stokers worth in this country $1.50 a day are paid in England about two-thirds as much. The average of thirty-five installations of the top, hand fed type, gives, on our basis, 41 cents per ton for labor. Nine direct charging plants show a labor cost of 44 cents a ton. Twelve plants in and about London cost an average of 48 cents per ton, and range from 23 to 82 cents. For none of the English brick destructors have I any data as to the repair costs. The best of the English plants of which I have record is not as cheap, at our labor scale, as the Atlanta incinerator.

Advocates of the English systems of destruction will reply that this difference in labor cost is more than compensated by the value of the power produced and utilized. I grant without discussion that England leads us in the application of power from refuse destruction. That more steam is produced in English destructors than in incinerators of the type in Minneapolis and Atlanta, I doubt. During my visit to the Minneapolis plant steam was escaping copiously into the open air at 50 pounds gauge pressure, and at Atlanta the same was true at 30 pounds. It is an evidence of poor municipal economy, rather than poor furnace construction, that this steam is not profitably utilized.

Of the furnaces in New York and Boston burning only combustible rubbish little need be said. A careful comparative calculation showed that the Forty-seventh street incinerator in New York is being operated at a cost to the city of $313 per week, or nearly $2 per ton, over and above the former cost of taking all rubbish to land fills. This makes allowance for all power utilized and the better picking facilities afforded by a belt conveyor.

In Boston the city pays by the year an amount equivalent to 50 cents a ton, and then disposes of the ashes. No utilization of power is made except for plant purposes.

The general practice of picking over refuse for the recovery of glass, rags, metal and paper is perhaps the most pernicious ever allowed. I venture to say that it costs the country more, owing to its dissemination of tuberculosis and other contagious diseases than it can possibly net the city in payment for picking privileges.

Complete incineration is the only ultimate solution of the final disposition problem, and the Atlanta type of incinerator has given the best results so far realized.

THE PRESIDENT: Those two papers are now open for discussion.

MR. RUST: Might I ask Mr. Bayles if he knows what was the cost of the Atlanta plant?

MR. BAYLES: I have not the first cost in detail, but I know that the plant was put in at a reasonably low cost—at least I was told this in Atlanta, because the company which put it in wanted to open up the southern field, and show what it could do. I believe they told the Atlanta officials after the first one was finished that they would not duplicate it for less than twice the amount they installed the first one for. One of the Atlanta officials told me that the Atlanta council intended to pay twice the cost of the first one to have another plant of the same kind, as soon as they could get their next year's appropriations through.

MR. SKAIFE: It might be interesting to know that the Town of Westmount, one of the outskirts of this city, intends to put in an English incinerator, and we expect to get quite a good return in horse-power out of it. I do not know the name of the maker or anything else about the details, but it has been decided so, after the matter was thoroughly gone into.

Mr. Howard: I saw the Trenton plant when it was not working very well. A great deal of flying particles were going about, and there was some danger of fire. I understand that this was afterwards suppressed.

Mr. Decarie: The plant that they propose establishing at Westmount is what is called the "Horsfall" of England.

That was purchased because the people of this country are not in a position to get tenders, or to give any information in Canada or the United States. I endeavored to get our plant before the officials of the town, but it was no use, and I know that they decided to purchase a "Horsfall," which is something like the one they have in the City of Montreal.

BY LETTER.

Mr. J. T. Fetherston, Acting Superintendent Bureau of Street Cleaning Borough of Richmond, New York: Referring to the paragraph concerning the Dixon furnace in the Borough of Richmond (Staten Island) several statements are made which are partially or wholly incorrect. The second and third sentences read:

"Here the cost for labor, fuel and repairs in 1903 was $2.44 a ton. In 1904 it was $2.88, and for the first six months of 1905 it showed a cost of $3.47."

The above costs are really based upon supervision, supplies, labor, fuel and repairs, not upon "labor, fuel and repairs" alone. The cost for the first six months of 1905 was taken from a progress report, and should not have been quoted as a representative cost without explanation. Later, in the same paragraph, the author states:

"The ash is from 25 to 30 per cent of the weight of the material burned. This means incomplete cremation." No figures on ash resulting from the burning of garbage in the Dixon furnace in this borough were given to the author of the paper on the occasion of his visit to the writer's office, so there is an error in this statement and consequently in the deduction that cremation was incomplete.

The high cost of burning garbage in this inefficient type of Dixon furnace is due to the necessity for completely cremating the material, as the furnace is located in a business and residential section, where nuisances due to incomplete destruction of decomposable matter would quickly be suppressed. No complaints have been received against the crematory during the past year.

Concerning the Smith crematory at Atlantic City, the author states:

Mr. J. T. Fetherston kept a careful record of a week's run one summer when it was running full and consequently at the least tonnage cost, and calculated $1.48½ per ton."

This statement, in connection with the author's cost ($1.70 per ton through the year), is misleading and incorrect. The writer spent one week during the summer of 1903 at the Smith crematory, Atlantic City, in making observations, conducting a check run of the plant and collecting data on costs. The figures quoted by the author ($1.48½ per ton) was an average cost for two years (1901-1902) and included supervision, labor, supplies and repairs, figures being obtained from official documents in the office of the comptroller of Atlantic City.

BY LETTER.

MR. BAYLES: It is always unfortunate to misunderstand what is told one. I have had some correspondence with Mr. Fetherston which does not appear here. With some difficulty I recalled to his memory the fact that he *had* given me several ash percentages. They were, he explained, the results of special test runs made with selected and weighed refuse, and not representative of normal operation. That I misunderstood their significance was deplorable, but I must insist that it was purely misunderstanding, and not willful misrepresentation. The same causes are responsible for my having stated incorrectly the manner in which the Atlantic City figures were arrived at. In the matter of the Dixon crematory on Staten Island, it would have been more exact to have stated that the cost per ton covered operation and maintenance. The intention was to express the idea that it covered all costs properly chargeable against the plant. My apologies for having been inexact in saying so.

It gives me pleasure to quote one of the most eminent engineers of the country in saying that Mr. Fetherston's report on the Atlantic City plant is probably the most exact and comprehensive ever prepared.

THE PRESIDENT: If there is no further discussion on those papers, we will pass on to the next item on the order of business, which is the report of the Committee on Street Lighting—"Electric Lighting, with Special Reference to Underground Construction," by the chairman of the committee, Mr. E. A. Fisher, Rochester, N. Y.

Mr. Fisher presented the following report of the committee:

REPORT OF THE COMMITTEE ON ELECTRIC STREET LIGHTING.

BY EDWIN A. FISHER, CITY ENGINEER, ROCHESTER, N. Y., CHAIRMAN.

The chairman of your Committee on Electric Street Lighting regrets that he cannot submit a committee report, but is obliged to beg your indulgence while he presents a brief paper upon the subject, having special reference to the portion of the lighting plant occupying the public streets.

SYSTEMS OF ELECTRIC STREET LIGHTING.

Incandescent lamps are not adapted to street lighting and are not so used, except in special cases, and will not therefore be considered.

Electric arc lights may be divided into two general classes, the open arc and the enclosed arc. The enclosed arc is rapidly superseding the open arc to the great improvement of street illumination. Mr. W. D. A. Ryan, in summing up the results of a series of careful experiments to determine the relative merits of open and enclosed arc lights for street illumination, says: "Open arcs give a higher maximum candle power than enclosed arcs of corresponding voltage, but the maximum candle power is in an undesirable direction and the light fluctuates through very wide limits.

"Enclosed arcs give a higher candle power through the most useful angles from 3° to 10° below the horizontal. The light is more uniform and steadier and generally superior, from an illuminating point of view, to the open arc."

It may also be said that they are less affected by unfavorable weather, and the outages are materially less.

The enclosed arc is maintained for much less than the open arc, and we therefore have a condition where it is to the financial interest of the lighting contractors to comply with the demands of the public for the most efficient light.

Arc lights may also be again divided into two general classes, constant potential or multiple arcs, and constant current or series arcs. There is no material difference in the quality or quantity of illumination in lamps of the same capacity, in the two systems. The first or constant potential lamp is used where it is desirable to limit the voltage, and generally near the center of distribution. The current on the conductors is usually about 110 volts. This is reduced in the lamp from 72 to 80 volts.

The system generally used is the constant current or series arc. The voltage on the line depends upon the number of lamps in the current, it being generally about 76 at the arc. The number of lamps in general does not much exceed 50, making the maximum line of voltage about 4,000.

Both of the latter systems may be again subdivided into the direct current lamp and alternating current lamp. Mr. Ryan made a careful study of the relative merits of the direct current enclosed lamps and the alternating current enclosed lamps, and arrived at this conclusion:

"The direct current enclosed arcs produce slightly higher candle power than alternating enclosed arcs of corresponding voltage, but so far as illuminating value is concerned the two lamps are, generally speaking, on a fair basis of equality, both being superior to the direct current open arc."

The luminometer tests of Mr. Ryan show that the direct current lamp illuminates about 4 per cent greater distance than the alternating current lamp of same voltage. Tests by the writer of lamps in use in Rochester, N. Y., gave similar results.

There are, however, important advantages to the operating company in the alternating system, and it is now used in many cities. The General Electric Company, in its Bulletin No. 4359 of January, 1904, says: "Since the introduction of the alternating current enclosed arc system in 1898 orders have been received from over 700 central stations for 1,650 transformers, having a total capacity of 82,500 lamps."

Alternating current lamps should be equipped with street reflectors. It should also be remembered that true watts, or the reading of the watt meter, is the measure of the capacity of the alternating lamp, and not the apparent watts or the product of the volts by the amperes. Thus a 7.5 ampere alternating lamp is substantially equivalent to a 6.6 ampere direct current lamp of the same voltage.

The use of the alternating current of high potential on overhead wires in close proximity to telephone wires paralleling the same interferes more or less with the use of the telephones on these parallel lines.

The direct current open arc system in Rochester has recently been changed to the alternating current enclosed system. The lamps are about 7½ ampere and not less than 450 true watts. The circuits have about fifty lamps each.

Considerable interference was caused at first to the telephone currents on overhead lines on the same poles and in proximity to the electric lighting wires, and fears were expressed that the telephone service would be rendered useless during the operation of the lights. In December last the writer received replies to a letter of inquiry relating to the matter from the folowing cities that have had the alternating current series arc lamps in use:

Des Moines, Iowa	378 lamps.	6½ amperes.
Hartford, Conn.	804 "	6¼ "
Lowell, Mass.	530 "	6½ "
Trenton, N. J.	432 "	7½ "
Holyoke, Mass.	493 "	6.6 "
Atlanta, Ga.	901 "	

The maximum voltage was generally about 4,000. The replies from all, except one city that had no trouble, stated that there was at first some interference, but that it had later been taken care of by the telephone and the electric lighting companies so as not to materially interfere with telephone service. There is no trouble whatever in the underground wires. Rochester has 2,455 alternating current series lamps, and is passing through exactly the same experience as the cities named.

CLASSIFICATION OF ARC LAMPS.

Electric arc lamps for street lights are popularly classified in terms of candle power, and by electricians in watts energy per lamp. What is known as a 2,000 c. p. lamp requires in the lamp, according to New York City specifications:

On direct current	425 watts
On alternating current	450 true watts
Rochester specifications (at arc)	450 true watts
1,200 candle power—	
New York City specifications, direct current	320 watts
New York City specifications, alternating current	350 true watts
Rochester specifications, alternating current (at arc)	360 true watts
900 candle power—	
New York City, direct current	230 watts

The 900 c. p. lamps in New York are used in pairs. The 360 watt lamps in Rochester are used on the constant potential system and mostly in pairs.

Another method of designating the capacity of arc lamps on the series system with uniform voltage in each lamp and constant current is as follows:

7.5 Ampere lamps, called 2,000 c. p.
6.6 Ampere lamps, called 2,000 c. p.
5.4 Ampere lamps, called 1,200 c. p.
4.4 Ampere lamps, called 1,000 c. p.

The actual candle power of the arc lamp is much less than the nominal candle power, and is very difficult to determine For this reason the National Electric Light Association in 1894, at its seventeenth annual meeting, appointed a committee, mostly professional men, to consider and report a definition of a 2,000 candle power lamp. The report of the committee was as follows:

"Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligations of the products of electricity for illuminating purposes to the consumer thereof, be it

"Resolved, That in the opinion of the convention what is ordinarily known as a 2,000 candle power arc lamp is one requiring on the average 450 watts for its maintenance, the measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc. In case such resistance is used it must be excluded in the measurement of the voltage."

In addition to the unanimous testimony of practical electricians in favor of the resolution, the late Professor Rowland, acknowledged to be the highest scientific authority on the subject, said:

"It seems absurd to call a thing 2,000 candle power when it is not 2,000 candle power. You cannot by calling it that make it so. If you draw your contract to furnish 2,000 candle power, then you have got to furnish 20 or 30 amperes. * * * The only right way of doing it is to designate the number of watts, or, if you want to divide it up, you may also give the number of volts and amperes. That means something scientifically; but to say so many watts make a 2,000 candle power light cannot be maintained. The proper way is to decide the amount of current and *say nothing about the light,* and then if you want to know how many candle power of light it is, I hope you will be honest enough to say that it is about 500 candle power."

CAPACITY OF ARC LAMP BEST ADAPTED TO GENERAL STREET LIGHTING.

Mr. Ryan, in addition to the studies in street lighting heretofore referred to, investigated the question of small versus large units for economical street lighting. He shows that for a certain standard of illumination there was required in one mile of street:

10.68—7.5	**Ampere,**	**485**	**Watt,**	**alternating**	**current**	**lamps**	**using**	**5,180**	**watts current**
11.63—6.6	"	**425**	"	"	"	"	"	**4.940**	"
13.41—5.4	"	**350**	"	"	"	"	"	**4,640**	"
14.85—4.4	"	**285**	"	"	"	"	"	**4,235**	"

The relative lighting distance efficiencies, taking the 4.4 ampere 285 watt lamp as a basis, are as follows:

285	Watt,	Alternating	Current	100	per	cent.
350	"	"	"	90.2	"	"
425	"	"	"	85.7	"	"
485	"	"	"	81.7	"	"

Taking into account the power used only, the smallest unit practicable to operate is the most economical. The fact is, however, that the cost of producing the current for electric lights is from 40 per cent. to 50 per cent. only of the total cost of an arc light, and the saving in current would therefore be partly offset by increased initial cost and maintenance per mile for the additional small units required.

PRESENT PRACTICE.

Statistics gathered by Mr. C. F. Lacombe, engineer surface construction, Boroughs of Manhattan and the Bronx, published in the annual report of the Department of Water Supply, Gas and Electricity for the year 1903, shows that out of ninety cities supplied by private plants sixty-eight, or 75½ per cent used the 2,000 nominal candle power 450 watt lamp. The remaining 24½ per cent, with one exception, used 1,200 nominal candle power, 320 to 350 watts. Municipal plants show similar percentages. One city only, Cincinnati, uses alternating current series lamps of 4 amperes 75 volts, or 300 apparent watts. These lamps are not allowed to be set over 300 feet apart in the business district, and not over 400 feet in the residence sections. They are set very low on small iron poles, and from a personal observation I should say that while lighting the streets fairly well they do not illuminate the buildings, and the general effect is not as good as when larger units are used.

The lamp specified for the main part of the city lighting by the commission appointed by the mayor of New York City, consisting of Dr. Cary T. Hutchinson, Mr. Nelson P. Lewis, past president of this Society, and Mr. George F. Sever, was a 7.5 ampere alternating current series enclosed arc lamp requiring about 480 watts at the lamp terminals.

The specifications for the City of Rochester, made in 1902 after careful investigation, provide for a similar lamp for the larger portion of the street lighting.

While the unit generally used is the 2,000 nominal candle power, or 450 watt lamp, the writer is of the opinion that in any new installation or change, the question of a somewhat smaller unit should be considered. The number of lamps needed per mile is determined largely by local conditions, such as street intersections, kind of buildings, use made of the street, etc. In general, it may be stated that 450 watt lamps spaced 400 to 500 feet apart in fairly built up sections will give good lighting. In the business district this distance may be reduced to from 100 to 200 feet, and in unsettled sections made from 600 to 800 feet.

LAMPS AND OTHER FIXTURES.

For a description of modern lamps and appurtenances in keeping with improved conditions in city streets, reference may be made to the bulletins on the subject by the electrical companies furnishing these supplies. The writer also begs leave to refer to the papers printed in the Ninth Annual Report of this Society by W. H. Hillman on "Improvements in Electric Arc Lighting," and by Mr. Austin S. Hatch on the "Records of the City Electrician."

COST OF ELECTRIC LIGHTS.

In the 1903 report of the Department of Water Supply of New York City, heretofore referred to, is a table showing the cost per year and number of lamps of 2,000 nominal candle power in use in sixty-eight cities purchasing from private companies, the lowest being $60 per year, the highest, except New York, $125 per year; and the average, $88.60. New York paid $146. In twenty-three cities using 1,200 nominal candle power lights the lowest was $55, the highest, except New York, $109.50. New York paid $125.

In six cities operating municipal plants using 2,000 candle power lamps, the average cost was $66.45 per year; the lowest $47, and the highest $90. Similar costs for three cities using 1,200 candle power lamps show an average of $56.84. Higest, $68.54; lowest, $48.

The first number of *Municipal News* gives the statistics of cost of the sixty-nine 2,000 nominal candle power plants referred to.

Bare figures of cost without expert examinations into the conditions affecting actual cost are of value only in a general way in determining whether the price is fair or excessive in a given locality. In general the writer is of the opinion that, under ordinary conditions, where a municipality is well served at a rate in the vicinity of $75 per year for a 2,000 nominal candle power lamp, it would be inadvisable in the present unsettled state of the art of illumination to resort to municipal ownership.

ELECTRIC SUBWAYS.

A considerable portion of the arc lighting in the larger cities is in districts having underground conduits. The New York City report heretofore referred to states that Philadelphia had 9.15 per cent of its arc lights on underground wires, Cleveland and Newark about 10 per cent each, Milwaukee and Baltimore about 11 per cent each, Providence 13 per cent, Cincinnati 21 per cent, St. Louis and Chicago about 33 per cent each, and Washington 99 per cent. Rochester has about 15 per cent.

Previous to 1886 electric wires for all purposes were usually overhead. The enormous increase in poles, fixtures and wires disfiguring and obstructing the main streets led to an urgent demand by the public for a better system. The electric field at that time was occupied by numerous competing companies. The almost universal custom was to grant consents to these companies to construct subways in public streets and order the removal of overhead wires. The City of Boston is an example of this method. In 1901 the commissioner of wires having in charge this branch of the public service granted 1822 permits for underground construction, covering 147 different streets. These permits were granted to four different corporations for electric lighting and power purposes, and to fourteen different users of electricity for low tension service. Eight of the latter used conduits in common under the name of the Boston Low Tension Wire Association. The commissioner of wires informed the writer that it was the custom to grant permits for the construction of subways in the streets so long as there was sufficient room to place them.

In Rochester the Bell Telephone Company owns and occupies about thirty miles of conduits. The city has the use of two ducts in each conduit for police and fire alarm wires.

The Rochester Gas & Electric Company has constructed about forty miles of conduits for general use, under a contract permitting the city to take it over at any time upon payment of the cost of construction.

An attempt by the city to compel the Bell Telephone Company to use these conduits resulted in a suit tried in 1901 before the Hon. Theodore F. Hancock as referee, in which some of the leading electricians in the country were called as experts to testify as to the question of danger in the use of a single conduit by both high and low tension wires. The decision of the referee was adverse to the city, largely because of the use of a common manhole for both kinds of service.

The question of the location of conduits in the larger cities is one causing a large amount of trouble to the officials having the matter in charge. Whether a system of open galleries, as advocated by Prof. Folwell at the Indianapolis Convention, will come into use, except in the largest cities, is doubtful. It may, however, be necessary for cities to take possession of the space under the sidewalks, or a sufficient amount of it to provide for the additional conduits necessary in the main streets.

It is the opinion of the writer that this is a branch of the public service that should be owned by and absolutely under the control of the municipality, irrespective of whether the lighting plant is a private or a municipal plant.

PUBLIC CONTROL OF STREET LIGHTING.

An economical and satisfactory service in the field of electric street lighting, street railways, gas and electric services of all kinds, and similar public utilities, requires a monopoly of the particular service for each locality.

The fierce competition between rival companies during the competitive era just passing has probably in some cases resulted in better service and lower prices. In most instances, however, it has left a legacy of over capitalized, poorly built, duplicated or triplicated plants to the present age of combination and consolidation. A similar condition obtains in respect to electric light and power consolidations.

The Municipal Electric Lighting Commission of the City of Baltimore said in a report made in February, 1900: "The commission is strongly of the opinion that open competition in service of the character rendered * * * can eventually have no other effect than to *increase* the *price*. This is the uniform experience of every city; a temporary reduction may be made, to be certainly followed by a *consolidation* and an increase in the price."

It may be asked, then how are the cities to obtain a satisfactory street lighting service at reasonable prices? There are three methods by which this will be acomplished:

First. By a proper appreciation of the self-interest of the corporation itself by its managers.

In a recent paper by Mr. Henry Wollman of New York, before the Commercial Law League of America, on the "Mortality of Trusts," he said:

"Trusts will live, not because they have great capital, nor because they have blotted out competition, but because they are conscientiously, economically and ably managed. Those that do not pursue the correct principles of business will go down. Those that are fortunate enough to do so will last. Those trusts that serve the public the best will survive; the others will perish off the face of the earth."

Second: By proper state supervision and control.

Massachusetts has for twenty years exercised such supervision and control through a commission of three members. New York has recently created a similar commission. Mr. Alton D. Adams, in writing of the powers and duties of these commissions, says:

"The commission in each of these states has general supervision of all persons and corporations engaged in the distribution of gas or electric energy by way of the streets or highways. In each state the power of the commission extends over both the physical and financial operations of corporations engaged in gas or electric supply. By the definitions of the New York statute, the term corporation covers a company, association and joint stock association, but does not include a municipality. The New York commission may regulate the physical operations of the gas and electricity systems operated by a city, village, town or lighting district, and may inspect the books relating to these systems, but cannot control the financial doings of a municipality in relation to its gas or electric business. In this respect the Massachusetts commission has greater powers, for it can fix, under certain conditions, the rates at which a city or town shall furnish gas or electric service to private consumers.

"No municipality in New York can erect and operate a gas or electric system for other than municipal purposes without authority from the commission. In Massachusetts this matter is not subject to the commission in any way, but it is provided by statute that a city or town cannot erect a gas or electric system, even for the sole purpose of lighting its own streets, without first buying the local system of the sort that it proposes to erect, if the owners of the local system elect to sell.

"One of the most important powers delegated alike to the New York and the Massachusetts commission is that of fixing maximum rates for electric and gas service. Neither commission can fix rates on its own motion, but can act in the matter only after a complaint to it has been made. In New York a complaint as to either the quality or rates for gas or electric service may be lodged with the commission by either the mayor of a city, the trustees of a village or the board of a town, in which a person or corporation is authorized to supply gas or electricity. One hundred consumers of gas or electricity may likewise bring a complaint before the commission as to quality or prices. After an investigation of the plant and books of the gas or electric system, and after a public hearing before it, at which all interested parties may be represented, the commission may order an improvement in the service, or may fix the maximum price to be charged for gas or electricity. The price so fixed is the maximum price that may be charged for gas or electricity by the person or corporation affected in that place for a period of three years and until, after the expiration of this period, the commission shall again upon complaint reconsider the evidence and fix the price of gas or electricity."

It will thus be seen that in two states at least the actual practical supervision and control of electric street lighting companies is an accomplished fact, and should result in good service at reasonable rates. This, however, does not prevent any community from resorting to the third and last remedy,

MUNICIPAL OWNERSHIP.

Comparatively few of the larger cities in this country have as yet gone into this branch of the municipal service. Chicago and Detroit are the notable exceptions.

Mr. M. N. Baker, in his Municipal Year Book for 1902, says: "The percentage of cities having municipally owned electric lighting plants rises steadily with the decrease in population, there being only four public to 121 private plants in places of 30,000 and over and 111 public to 449 private plants in towns of 3,000 to 5,000."

While the movement for municipal ownership is steadily increasing in all branches of municipal service, it is a source of gratification that the larger cities generally do not follow blindly the popular trend, but make careful and thorough investigations before making a final decision. In this way only will progress toward the right settlement of this question be made.

MR. ROOT: Mr. President, before we proceed to the discussion of this paper, I would like to say a word in reference to the last two papers, in connection with the plant at Atlanta, if you will kindly permit me to do so.

I wish to say for the benefit of the members that our company (The Decarie Manufacturing Company, Minneapolis, Minn.) constructed the plant, and it was very gratifying to us to hear that the results had been so satisfactory. We did the job for $31,000 and charged up $26,000 against the plant for advertising. We had to break into the South, and break into business there, and we built that plant to handle the offal of the city, and built it successfully, I think.

We duplicated that plant at Los Angeles, California, for $71,-

000, and they think it is very cheap at that figure, so I guess we are going to raise the price.

Mr. Sherrerd: With reference to Mr. Fisher's paper, I would like to ask him a question in respect to the trouble between the two kinds of wires carried in the conduits. Were there any high tension wires? I mean anything above two thousand volts?

Mr. Fisher: Yes, sir, they run as high as 6,600 volts.

Mr. Sherrerd: And was the complaint from the telephone people?

Mr. Fisher: No. The question came up in this way. In 1892 a contract was given to the Rochester Gas & Electric Company to construct conduits in those streets, and that contract has been continued from time to time under an agreement by which the city has the right to take the conduits over at any time on payment of the cost.

In this contract it was specified that they should be built of sufficient size to take in all the wires of all the other conduits. The city then asked the Bell Telephone Company to abandon the construction of its system, and to go into the conduits of the Rochester Gas & Electric Company. This they refused to do, and that was the cause of the suit.

They first put in use this alternating system of lights, and run a voltage through the conduits of about four thousand. The result was that there was considerable interference with the telephone service—in fact I may say that there is still. I corresponded with some eight or ten cities which have been placed in the same position, and found that they have all had practically identical experiences, but they said that it had in time taken care of itself and that the electric light companies and the telephone companies had rearranged their wires in such a way that there was practically no difficulty.

Our experience has been that even yet the telephones are difficult to use in some parts of the city, but we hope that this will be overcome in time. Of course, in some parts of the city there is no trouble at all.

Mr. Sherrerd: Where those high tension wires are run near telephone wires there is always a good deal of trouble. There is a special form of cable in which they run the telephone wires now, but I understand that when you get up into the really high voltages, such as 10,000 or 12,000 volts, that the telephone companies still have the same trouble as they always had, even if the lines are some thirty or forty feet apart.

I think that this is a question that is deserving of some consideration, because it is going to give a good many cities considerable trouble in the installation of conduits which may be used by the electric light companies, and by the telephone companies.

Mr. Fisher: We have not any trouble to speak of now, and we have no trouble where the wires are underground, any more than any of the other cities that I corresponded with. We have the wires running right in adjacent ducts in the same conduit. Of course they are in a cable, but they do not give us any trouble whatever. With the overhead lines there was trouble.

Mr. Sherrerd: I understand that they have trouble with the telephone wires overhead, while the very high tension wires are in the conduits underground.

Mr. Fisher: I hardly think that is possible. We have them in adjacent ducts, as I say—not more than two feet from each other, and there is no trouble whatever.

The President: If there is no further discussion on this paper I will call upon the chairman of the Committee on the Place of Meeting to present the report of the committee. I understand that this report is ready for the meeting.

Mr. Pollock, Chairman of the Committee on the Place of the Next Annual Meeting, then presented the following report:

Montreal, September 6, 1905.

Your Committee on Location of Thirteenth Annual Convention have received invitations from Chicago, Birmingham and Bedford Springs.

The latter is simply a hotel and was practically left out of consideration. After several meetings the committee could not decide unanimously upon any one location to recommend and prefer to have the convention select a location without a definite selection from us.

Respectfully submitted,
C. D. POLLOCK, Chairman.
J. S. VINSON,
E. S. BARROW.

Mr. Grosser then read the following as the report of the minority:

MINORITY REPORT OF COMMITTEE ON LOCATION OF THIRTEENTH ANNUAL CONVENTION.

MONTREAL, CANADA, September 6, 1905.

The committee met at 7:45 P. M., September 5th, and selected Mr. Samuel A. Freshney as Secretary. Invitations were presented from Chicago, Ill., Birmingham, Ala., and Bedford Springs, Pa. The last place being simply a hotel, we scarcely considered it. The principal point against Chicago was the fact that we held a convention there in 1896. After considerable discussion the committee decided to recommend Chicago for next year. We felt very friendly towards our friends from Birmingham because they have been very faithful in attending our conventions at long distances from their city, but think it better to advise the selection of Chicago for 1906.

If we should succeed in getting a large increase in membership next year and Birmingham should invite us there for 1907, your committee would like to recommend Birmingham very strongly to your next year's committee.

Respectfully submitted,
HUGO S. GROSSER,

MR. HOWARD: Mr. President, I would move that the next meeting of the American Society of Municipal Improvements be held at Birmingham, Alabama.

I do not do this because any other city has been mentioned, but the report of the committee does not seem to suggest any place in particular, and we have never met in Alabama. Now, as a matter of fact we help the city where we meet, in a small way it is true, but still we help it, and it is only right that we should do our share in helping a city which has done the United States proud. If I can find a seconder I will put my motion before the meeting.

The motion was duly seconded by Mr. Rust.

After some discussion the motion was carried.

THE PRESIDENT: It is therefore the sense of this Society that the next annual meeting be held at Birmingham, Alabama. According to the Constitution the meeting will be held the second week in October, unless the Society decides otherwise. I suppose the best plan would be to hold the meeting according to the date set by the Constitution. I think that October would be about the best time of the year to visit the Southern city. It might be different in the North.

We will now proceed with the order of business. Our next business is to hear the report of the Nominating Committee. Mr. Sherrerd, are you ready to present the report of the committee?

The Nominating Committee's report was as follows:

MONTREAL, September 6, 1905.

Members of the American Society of Municipal Improvements:

GENTLEMEN: Were it not for the provision of the Constitution which states the President shall not be eligible for immediate re-election (unless by a unanimous vote), your Committee on Nominations recognizing the distinguished services rendered to the Society by our present efficient and energetic President, the results of whose efforts are shown in our increased membership, and the renewed interest taken in the Society, would have unanimously presented the name of Mr. Folwell for re-election. We, however, considered that the establishment of such a precedent might prove embarrassing in the future.

Your committee therefore recommend the following nominations for your consideration:

President—C. C. Brown, Indianapolis, Ind.
First Vice-President—John R. Barlow, Montreal, Canada.
Second Vice-President—Jas. Owen, Montclair, N. J.
Third Vice-President—Julian Kendrick, Birmingham, Ala.
Secretary—Geo. W. Tillson, Brooklyn, N. Y.
Treasurer—F. J. O'Brien, Oswego, N. Y.
Finance Committee—E. S. Barrow, Hamilton, Ont.; A. F. Eggers, Newark, N. J.; Fred Giddings, Atchison, Kan.

Respectfully submitted,
M. R. SHERRERD, Chairman,
C. H. RUST,
E. A. FISHER,
JOHN R. BARLOW.

THE PRESIDENT: Perhaps it might be in order for me to say a word of thanks for the compliment so delicately expressed in the opening words of the report, but I am glad that the committee has decided as it has, for I should have been obliged to decline the honor of re-election. I think it is a good provision laid down by the Constitution that the officers shall be elected every year, and that the same ones must not be re-elected.

MR. HOWARD: I move that the Secretary be instructed to cast a ballot declaring the officers nominated as elected for the coming year.

Which, being duly seconded, was carried, and the Secretary cast the ballot and reported the officers nominated by the Nominating Committee as elected for the ensuing year.

MR. BROWN: Mr. President, and gentlemen of the Society: It is too late now to make any lengthy speech, but I wish to express my gratitude to you for the very kind way in which you have elected me President of this Society. Of course I have been with the Society since the year two, if not the year one, so I know something of the ups and downs of the Society, and I know this, that the work of the officers during the past year, especially the work of the President, has resulted in a greater membership this year than we have ever had, and a better convention than we have had for a long time.

I can only add that I shall do all in my power to keep up what has been done already, and we hope that next year we will be able to report that the membership has increased quite as much, if not more, than it has this year, and with the help of our good friends from Birmingham we hope that our next convention will be as successful as this one.

I thank you again for your kindness.

THE PRESIDENT: There is one other subject that I would like to put before you before we adjourn. There was an amendment to the Constitution offered the first day of this meeting. You all remember it. It was to strike out the last clause of the first paragraph of Section 1, Article II, so that the section would read:

"Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work."

The second amendment consists in striking out Article III altogether and replacing it by the following: "Each corporate member shall pay five dollars per annum, and each associate member shall pay ten dollars per annum. All dues to be payable in advance, on or before the date of the annual meeting."

MR. SHERRERD: I move that those amendments be adopted and that they form part of the Constitution.

Which, being seconded by Mr. Eggers, was carried.

And there being no further business before the meeting the session was adjourned.

FOURTH SESSION.

The fourth session was called to order by the President at 10:40 Thursday morning, September 7th. After the meeting had been opened formally, the President said:

We have the honor of having with us this morning His Honor Judge R. Stanley Weir, Recorder of the City of Montreal, who has kindly consented to read a paper to us on the subject of "Montreal Past and Present." I have much pleasure in introducing Judge Weir to you.

Judge Weir presented the following paper:

MONTREAL PAST AND PRESENT.

In attempting to comply with the request to discuss before you "Montreal Past and Present," I cannot but feel that the subject is one to be treated more adequately in a series of discourses or rather in a volume than in the necessarily brief limits of the present occasion. Montreal Past for instance, might lead us to a consideration of its interesting geological history, *i. e.,* the volcanic features of what we call our mountain traceable in its igneous rock—the same igneous rock that has preserved St. Helen's

Island from disintegration and that still defies the fury of the Lachine Rapids. Our topic more legitimately would permit us to discuss the site of the ancient village of Hochelaga, the probability favoring a location not far from where we are now assembled. It would surely be permitted us to tell the story of Jacques Cartier, the intrepid sailor of St. Malo, who 370 years ago landed here to the astonishment of the Indian encampments here, and of how in the words of one of our own poets, McGee,

"They brought their sick and maim'd for him to breathe upon
And of the wonders wrougth for them thro' the Gospel of St. John."

I may at least remind you of that memorable morning, the 17th of May, 1642, when a little flotilla containing Paul Chomedy de Maisonneuve, Montmagny, the governor of New France; Peter Vimont, the Jesuit Father, Madamoiselle Mauce, Madame de la Peltrie and others landed not far from where His Majesty's Custom House now stands. Their first act was a religious one, and when the rite was over, Pere Vimont turned and addressed the small company: "You are a grain of mustard seed," said he, "that shall rise and grow till its branches overshadow the land." And to quote the picturesque, if somewhat fanciful language of Parkman: "The afternoon waned; the sun sank behind the western forest and twilight came on. Fireflies were twinkling over the darkened meadow. They caught them, tied them with threads into shining festoons, and hung them before the altar. Then they pitched their tents, lighted their bivouac fires and lay down to rest. Such was the birthright of Montreal."

Although the population of Montreal under the French regime was small, the characteristic methods of that time were continued for many years, long after the cession to Britain. The narrow streets, the general style of construction of houses, the assemblage of farmers on market days, the crying of notices on Sundays after mass at the church doors and many other features might be instanced. Of course, there were no town councils or public meetings before the cession, and the chief ruler seems to have been the official known as the intendant. The intendant was appointed by the King of France and stood inferior to the governor alone in rank, while probably exceeding him in practical control of affairs in times of peace. He it was who forbade the habitants from galloping or racing their horses on leaving church, who laid down rules for the construction of houses, defining the angle of the roof and the thickness of the stone and also the alignment of the streets. It was the intendant who made regulations against fire; against nuisances and forbade children or grown persons to slide down the hills of Quebec and Montreal to the danger of pedestrians. Some of the intendant's ordinances were exceedingly strict, as for instance the forbidding of farmers to visit the town unless by special permission.

After the cession, General Murray who succeeded General Wolfe in command of the troops, administered municipal affairs with the assistance of an executive council, sitting at Quebec. Under the Quebec Act of 1774, which continued the system of government by an appointed executive, and under the Constitutional Act of 1791, which provided for an elected parliament in addition to an appointed council, justices of the peace were the administrators in the City of Montreal. The central council or parliament enacted the laws under which the city was governed and entrusted the board of justices with the duty of seeing that they were obeyed. This was the system until Montreal received its first charter.

Although two hundred and sixty-three years have fled since Paul Chomedey, Sieur de Maisonneuve, planted the fleur de lis and cross at Ville-Marie, the city as a body politic and corporate is barely seventy-three years old, the royal assent of its first charter having been signified on June 5, 1832. The city was styled "The Corporation of Montreal." It was accorded certain borrowing powers, since enlarged to a degree that would have made old Jacques Viger, the first mayor, stand agape. It was also authorized to hold and possess goods, chattels, lands and tenements, real and immovable property; also to sue and be sued, to plead and implead, to have a common seal, "and the same from time to time at their will to break, alter and amend." The charter was brief, compared with the present one, containing but twenty-six articles, whereas that of today has nearly five hundred, and may in time, if the legislature continues its polite attentions, equal that of, say, St. Paul, Mo., which has seventeen hundred and ninety-four sections, covering over a thousand pages; or that of Brooklyn, where, in answer to a request for a copy of the city's charter, the mayor wrote me almost dolefully: "There is no charter, for the legislature so amends it every year that it is impossible to give the exact laws that govern." By its first charter, Montreal was divided into eight wards, namely, East, West, St. Anne's, St. Joseph, St. Anthony, St. Lawrence, St. Louis and St. Mary. The limits of these boundaries, which there is not time to mention, possess much interesting topographical and antiquarian information. Who now remembers the Little river and Charland's new bridge in the West ward, or la Pointe a Callière in St. Ann's? How the sight of the names Rocollet and Quebec Suburbs, La Place des Commissaires and St. Anthony's ward, must carry back the memories of old inhabitants! Citizenship was limited to every male person of the age of twenty-one years being proprietor of a house, and of the ground on which the same is built, or of a vacant lot of ground within the city, and who shall have resided in the city during twelve calendar months before the time of election." All such persons were styled members of the corporation.

A good deal of wisdom is discernible in this first charter. The mayor was styled "chief executive officer." It was his duty to be vigilant and active at all times in causing the laws for the government of the city to be duly executed; and as far as was in his power to cause all negligence, carelessness and positive violation of duty to be duly prosecuted and punished. These duties were wholly omitted from later charters, and in the revision of 1889 not a line was given to defining the duties of the mayor beyond the bald statement that he shall preside at all meetings, is ex-officio a justice of the peace, and entitled to draw a salary of not more than $2,000 per annum. The revision of 1899, besides doubling the mayor's indemnity, has given him important powers of veto and control.

For the election of the first common council the justices of the peace, who, prior to this date, were civic administrators, held a special session on the first Monday of May, and appointed the place of election in each of the wards. Notice of this meeting was given by publication in all the newspapers of the city, and at the doors of the churches after divine service in the mornings of the two Sundays preceding the election. The duly qualified members of the corporation were then permitted to meet at the place so appointed on the first Monday of June following to elect, for their respective wards, between the hours of 10 A. M. and 4 P. M., two common council men possessed of real estate of yearly value of £25 currency. Open voting was the vogue, and false swearing or personation was dealt with severely. Within fifteen days after their election the common council men met in the court house, "in the room in which the justices of the peace hold their special sessions," to elect one of their number mayor, and thereafter to proceed to the business of the corporation.

The common council was declared to have exclusively the same powers and authority as the justices of the peace for the city and town of Montreal possessed by law, touching police, assessments, streets, markets, weighing houses, watching and lighting, and generally over all things regarding the improvement, cleanliness and convenience of the city. The first meeting of the council, or corporation, as it was called, was held on June 5, 1833, and Jacques Viger, whose name is commemorated in the square that bears his name, was elected mayor, not by the people, but by the councillors, whose chairman he was to be. Each ward elected two councillors. The council, however, elected the mayor. I find also in this charter an excellent check on the council. It was there enacted that before having force and effect every by-law and ordinance had to be submitted to the Court of King's Bench for approval, after due publication by newspapers and the town crier. Our old charter also contained simple and effective expropriation regulations. When the city wished to acquire ground for opening new streets an attempt to purchase by agreement was made. If this failed, resort was had to arbitration; only in the case of proprietors being absent or refusing to conclude an agreement or appoint an arbitration, was recourse had to judicial arbitration; compulsory municipal service was also a feature of the city's first charter, it being enacted that if any person duly elected refused to serve in the common council he should pay the sum of £25 currency. This charter remained in operation until the first of May, 1836, too short a time to afford its merits a fair trial. For some reason that cannot be devined, the renewal of the charter was refused. "Since then," says Lord Durham, in his famous report, page 36, "These cities (referring also to Quebec, whose charter, identical to that of Montreal, was also refused renewal) have been without any municipal government, and the disgraceful state of the streets and the utter absence of lighting are consequences which arrest the attention of all, and seriously affect the comfort and security of the inhabitants." In April, 1836, the Governor-General wrote to the Mayor of Montreal, suggesting that in view of the approaching expiration of the term for which the charter was granted, the council would appoint a magistrate, with a suitable remuneration, to sit regularly for a stated time every day to hear and determine all cases cognizable by magistrate and to organize and pay a small but efficient body of constables or police officers to protect and watch the town. His Excellency believed that as this would be a purely local arrangement, and for the benefits of the inhabitants of the city, they would not object to raise amongst themselves by voluntary assessment the necessary funds for the purpose. On motion of the redoubtable Dr. Nelson, however, a respectful letter was sent in reply, in which the council pointed out that they could not exceed the limits of their charter, and in declining participation in the suggestion of His Excellency, assured him that "however unfortunate the city might be in not possessing municipal government, nevertheless it appears preferable to the common council that there should be none rather than to have one of arbitrary creation." This letter clause was, it may be imagined, rather intended to convey a hint as to the way in which government by a central executive, instead of by a common council elected by citizens, would be regarded.

On May 2, 1836, the Court of Special Sessions, which during the term of the city's charter had ceased to administer the city's affairs, resumed their sittings, and continued them until August, 1840. In the year 1840 the city received another charter from the special council that sat in Montreal in the Chateau de Ramezay from 1839 until the Act of Union of 1840. Its new corporate name was "The Mayor, Aldermen and Citizens of the City of Montreal." The Governor-General, the Hon. C. Poulett Thomson, was authorized to name the new mayor, aldermen and councillors for the first term, ending December, 1842, and his nominees were the Hon. Peter McGill, mayor, with eighteen councillors, among whom such familiar names as Ingles Quesnel, C. S. Rodier, J. G. Mackenzie, John Donegant, Colin Campbell, Stanley Bagg and William Molson are to be found. The population of Montreal in 1840 was 40,000, and yet eighteen representatives were not thought too many. In 1843 a new corporation was elected under the provisions of the charter granted by the special council. The city was divided into six wards only, namely, East Centre, West, Queen, St. Lawrence and St. Mary. Each ward elected three members. The council elected one of their number mayor, and six others as aldermen, the remainder being styled simply councillors. The mayor elected under this regime was Joseph Bourret, and the first elected aldermen of the city were Joseph Masson, Benjamin Holmes, William Molson, C. S. de Bleury, John Redpath and Joseph Roy. Among the councillors we meet for the first time the honored names of James Ferrier, William Lunn and John Mathewson. In 1844, by virtue of 8 Vic., Cap. 59, another arrangement of wards was made. The city was divided into nine wards. Three of these, East, West and Centre, were called city wards, and returned three members each; the remaining wards were called suburban wards, and elected only two members each. The full council thus numbered twenty-one, the population of the city then being about 45,000.

The next change in the constitution of the council took place in 1852, when, by virtue of 14 and 15 Vic., Cap. 128, 1851, the election of the mayor, who had hitherto been the choice of the council, was confided to the people. The number of aldermen was increased to nine, and the suburban wards, which had been steadily growing in population, were given the right to elect three members instead of two, all the wards thus having equal representation. This change increased the numbers of the council to twenty-seven, being one more than the present council, although the population of the city in 1852 was only 57,715. The numerous meetings which recent councils seem to find necessary for the dispatch of civic business is quite a modern feature—the statute of 1852 provided for only four quarterly meetings in each year. Special meetings, it is true, could be called by the mayor, but, failing his consent, a requisition stating the object desired was essential.

There have been revisions of the charter in 1889 and 1899, although every session of the legislature amendments are introduced not always, it is to be feared, with a view to the general interest.

MONTREAL PRESENT.

The problems of Montreal Present have been pretty much those of other modern cities called upon to deal with the new conditions created by the enormous industrial and commercial expansion of the past twenty-five years and the application of electricity to various public utilities. In common with many cities that have developed rapidly Montreal has suffered from more or less unavoidable lack of prevision, from more or less of imposition by companies authorized to exploit public franchises, more or less neglect to control in an orderly manner the various activities that have dug up her streets and erected forests of poles and impenetrable networks of wires. The almost simultaneous introduction of the telephone, the trolley car and the paved or asphalted street have resulted in some confusion with consequent waste of money and energy. Great as the addition to our convenience has been, the loss in beauty so far has been lamentable. Our cities in some respects are uglier than ever and are certainly noisier. But we are yet in a stage of transition. It is a question of time, and let us hope a short time, when these street poles will be removed and all overhead wires disappear underground. If, then, the storage battery replaces the trolley and the cable and the street car runs as it should, on rubber tires, the present Babel roar will happily give place to a reasonable hum that will bear less heavily upon our nervous senses.

FRANCHISES AND MUNICIPAL OWNERSHIP.

The whole question of the treatment of such a city as Montreal by the legislature and even by parliament is one which offers a good deal of difficulty and dissatisfaction. The city feels that it has too often to combat efforts to obtain special rights which ought to be referred to it exclusively. The feeling is general that the community is in constant danger of oppression from corporated interests who have won special favors from the civic council itself. It is not strange, therefore, that a good deal of jealousy, if not hostility, has shown itself against certain private companies that exploit public franchises without due regard to the principle of a fair quid pro quo. This jealousy or hostility, however, tends to be modified as the public feels it is being well and fairly served. It is quite noticeable that certain companies are popular in Montreal while others are exceedingly unpopular, and the measure of this satisfaction or dissatisfaction varies precisely as citizens feel that they are being fairly or unfairly served.

The familiar topic of municipal ownership has not yet reached the practical stage with us. Here again the modern city is in a condition of transition, or perhaps it would be better to say of inaction. This is because many corporations are in possession of legislative privileges extending over lengthy unexpired terms, the expropriation of whose vested rights would involve heavy expenditure, and also because the sentiment is very general that municipal ownership by no means guarantees either efficiency or economy. The ideal community where graft and nepotism and patronage are unknown is the community where municipal ownership may safely be practiced. In Montreal the chief difficulties are that the public utilities have all been exploited by joint stock companies who are in active and lucrative possession. The water system is municipally owned, and administered and in a fairly satisfactory manner; and if the way were clear to administer civic railways and electric utilities no doubt the attempt would be made. But there is a curious superstition widely prevalent that the city has no warrant in earning a surplus over expenditure in regard to the supply of water, and there would be the same tendency, it is to be feared, if the range of municipal ownership were widened. Education, experiment and experience, however, are potent factors in all human affairs and are likely to be applied in many cities to the question of municipal ownership.

STREET WIDENING.

The improvement of public roadbeds in streets and public places, consequent upon an appreciation of the superior beauty, economy and general utility of well paved thoroughfares, has called for large expenditures. The general demand for every city of even the most modest ambition is for clean streets—the dissatisfaction with dirty streets is a healthy sign. Montreal feels that she has yet a good deal to accomplish in regard to her streets, both in summer and in winter. Here again matters have not reached anything like a definitive stage, although the general consensus of opinion is that a general amelioration is urgent. The question involves large expenditure, but I imagine there would be no difficulty in collecting by taxation the necessary additional money, were a stronger feeling prevalent that an intelligent economy in administration could be secured.

One difficulty and financial burden peculiar to Montreal and involving large financial burdens has arisen from fact that the city, like Jerusalem of old, is most compactly built together. Many of the leading streets were extraordinarily narrow. St. Paul street, one of the narrowest streets in the city, gives one a fair idea of the original width of such important thoroughfares as St. James, Notre Dame and St. Lawrence streets. Many other streets also have been widened, and although we have been far from paralleling the Haussman frauds of Paris, it is generally admitted, to say the least, that the city has not dealt ungenerously with the proprietors who have been indemnified for the expropriation of their lands and buildings.

ANNEXATION OF SUBURBS.

At the present moment Montreal is negotiating with the numerous smaller municipalities which touch her circumference at every point for their formal and legal annexation with a view to the creation of a larger Montreal in partial fulfillment of the vision of a Greater Montreal to embrace at least the whole island with its area of about 350 square miles. The union of these adjacent towns and cities, for such they all are, with the metropolis is not coercive, but requires consent. Whether or not these eventually become attached to the city by formal legal bonds, the fact is clear that to all practical intents and purposes they actually form a part of the City of Montreal, owing their origin to it and being constantly dependent upon it. When these suburban places are well governed the larger city need not concern itself anxiously to secure their legal absorption, even at the sacrifice of a natural sentiment in favor of a Greater Montreal, but manifestly when they are administered recklessly as, for instance, in regard to matters of public health, Montreal is vitally interested. The negotiations between our city and the suburban towns to which I have referred illustrates an interesting consequence of our recently improved facilities for transit on which I may dwell for a moment. When a person is obliged to go on foot from his domicile to his place of daily business, it will be found that the maximum distance that he will be content to travel will be from three to four miles. But as this is speedily found to be irksome, the greater convenience having always the stronger attraction, a great many, rather than undertake this daily walk, will prefer to unite their domicile to their place of business, when possible, and such, in fact, was the practice for many decades in Montreal and elsewhere. In Montreal moreover climatic considerations, combined with the fact that hills and creeks interposed between the mountain and the river, to bring about *great density* of occupancy. The farmer, however, with his indispensable horse and vehicle could comfortably get himself to the center of old Montreal, transact his business and get home again from a distance of five or six miles. But for the same reason, if he penetrated farther into the unoccupied land, he would not care to be more than five or six miles from his neighbors. In England, where traffic has been horse traffic for many centuries, we find the country towns ranging according to the roads and gradients, separated and yet within touch at eight and fifteen miles, and this distribution there is singularly uniform. In accordance with a very similar law, the various villages that surround Montreal grew up distinctly separated from it by land more or less under cultivation, and yet within easy coming-and going-distance by horse. The horseless man got as close to his daily occupation as possible; the man with a passion for a villa, able to keep his horse, or if not, willing to trudge, moved out a few miles while the farmer or habitant was the outlying pioneer. It is easy to see how the development of trade through the invention of steam power, followed by the electrical tramway, have enormously altered conditions. The man with daily occupation in the city can fix his dwelling ten, fifteen or twenty miles away, and yet by cars or tramway be as punctual as the man whose dwelling is one, two or three miles distant, but who foots it. Thus we observe the truth of the law operating in the neighborhood of all modern cities that have adopted modern transport facilities, that the distribution of population is directly dependent on such facilities. Incidentally we see how it comes to pass that we have in this city a Greater Montreal—an overlapping of the old city into the surrounding territory. (See Anticipations by H. G. Wells.)

Gentlemen, it might, perhaps not unreasonably, be expected that I should give you the statistics of Montreal's rapid progress within say the last decade, dilate upon her still commanding position as the head of navigation and as a railway center. I might dwell upon her schools and churches and colleges on the one hand and the extent to which crime and drunkenness and the darker evils of city life exist or are combated on the other. I might discuss the administration of justice, the daily press, the place of art and letters, manners and morals, sports and pastimes, but these are matters of which some would require more time and more ability than I can claim, while the others are contained in any good guide book. I should feel happiest if I could encourage you in your most laudable efforts to realize ideals, to make our cities cleaner, honester, purer, lovelier and of better report. Practical idealists I would call you, and as such, bid you Godspeed.

MONTREAL AND THE UNITED STATES.

The early history of the United States is indelibly blended with that of Montreal, for it was from this city that many of the strong men of one, two and three centuries ago went forth to discover, to govern, to trade and to convert. On St. Paul street, just east of Place Royale, stood the birth place of *Pierre and Jean Baptiste Le Moyne,* the men who discovered the mouth of the Mississippi river, in 1699, founded New Orleans, and who were, between them, governors of Louisiana for forty-six years.

Between 1666 and 1668, *Jacques Marquette,* the great Jesuit missionary and discoverer, was a familiar figure in Ville-Marie, and he left the banks of the St. Lawrence on his voyage of discovery to the Mississippi. It was to Montreal that *Sir William Johnston,* of Johnston Hall, on the Mohawk, came in 1760, and on the site of the present Bonsecours market stood the residence occupied by his son, Sir John Johnston, Indiana commissioner, and it was here that peace conferences were held with the great Indian Chiefs Brant and Tecumseh.

At the corner of St. Peter and St. Paul streets stood the residence of *Robert Cavelier, Sieur de La Salle.* In 1666 La Salle came to Montreal, to go, ten years later, on his voyage of discovery into the Northwest and thence to the Gulf of Mexico. On the lower road leading from Montreal to Lachine can still be seen the remains of a fortified Seignorial chateau, which tradition asserts was the home of La Salle in the year 1668.

Near the Place d'Armes stood the house of *Sieur Duluth,* after whom the City of Duluth, Minnesota, is named. On Notre Dame street, west of St. Lambert Hill, was the residence of La Mothe Cadillac, who left the then little French village to proceed westward and found the now beautiful City of Detroit. A tablet on the Leeming Miles building, erected on this spot, records this fact. The Tourists' Information Bureau is in this building. In later years such men as *Washington Irving, General Montgomery, Benjamin Franklin, Arnold, Chase, Carroll* and *John Jacob Astor* followed one after the other to Montreal, each leaving a lasting imprint in the city's history.

A little tablet at the corner of Notre Dame and St. John streets, with the following inscription: "Forretier House. Here General Montgomery, emulous of repeating the great exploit of Wolfe, resided during the winter of 1775-6," reminding us that the city was once in the hands of our Southern neighbors. Sir Guy Carleton, whose name will always be associated with the Quebec Act, 1774, won back the city for us, and since then Montreal has stood secure, though again threatened during our troubles with the great republic to the South, in 1812-15. Its growth in population has been consistent. At the time of the cession to Great Britain the city had only a population of some 3,000; at the beginning of the last century this had increased to 12,000, and at the present time she boasts of some 350,000 inhabitants.

Besides these distinguished men, others might be named of more recent date who have done Canada the honor of paying it a visit from time to time. These gentlemen have usually left their native land in great secrecy and no small speed, and when efforts have been made in the name of international law to induce them to give an account of certain circumstances antecedent to their departure, have manifested extreme reluctance to leave their adopted country. We are not quite sure that we are very pleased to see such gentlemen among us; at all events we are not disposed to utter great lamentations when they are forced to return. So far as credible current history reports these gentlemen have never belonged to the American Society of Municipal Improvements.

CONCLUSION.

In conclusion, permit me to remind you, gentlemen, that while it is well that the material progress, comfort and stability of the modern city be well considered by those who are entrusted with administrative power and whom you are so qualified to advise, while it is well that all should be done that ought to be done for its health, good order and general welfare, we should never forget that the ideal city is one which also makes [illegible] effective appeal to the sentiment, the imagination, the patriotism of [illegible]. It is a great tribute to the indefinable but very real spell and charm of a city like Oxford that she should move one of her sons to write of her as 'that beautiful city so venerable, so lovely, steeped in sentiment as she lies spreading her gardens to the moonlight and whispering from her towers the last enchantments of the Middle Age, ever calling us nearer to the true goal of all of us, to the ideal, to perfection.' It is a great tribute to that true excellence which not all the appliances of modern ingenuity can create or destroy that a city like Athens can move an Englishman like Lord Macaulay to supreme enthusiasm.

"Of the triumphs of truth and genius over prejudice and power," he says, "in every country and in every age have been the triumphs of Athens. Wherever a few great minds have made a stand against violence and fraud in the cause of liberty and reason, there has been her spirit in the midst of them, inspiring, encouraging, consoling; by the lovely lamp of Erasmus, by the restless bed of Pascal, in the tribune of Mirabeau, in the cell of Galileo, on the scaffold of Sidney."

The [illegible] historical events of which Montreal has been the center from [illegible] make a [illegible] effective appeal to the sentiment and imagination of her citizens—not less strong should such an appeal be when one considers the probable future of the city, destined doubtless ere long to be the home of a million souls. It is the duty of every patriotic citizen, with the practical and scholarly aid that you gentlemen of this Association can give, to lay broad and deep and strong the foundations of the city, to create and hand down to posterity an authoritative tradition in favor of honest and [illegible] administration so that in respect of health and comfort, and all proper conveniences as a city of homes and as a city destined to great commercial and industrial achievements, as well as a city that values things beautiful and of good report, it may do its part to promote and secure in this country and wherever its influence may extend, the blessings of true urbanity—of true civilization!

THE PRESIDENT: I am sure we all thoroughly appreciate this most interesting paper of Judge Weir's, and I beg to thank him in the name of the Society for his exhaustive treatise of the many interesting bits of Montreal's history. I consider that we have been especially fortunate in having such an able exposition of such an interesting subject, and thank Mr. Weir, both for myself, personally, and on behalf of the members of the Society.

We will now proceed with the order of business as laid down by the program. Our next item is a paper on the "Montreal Civic Asphalt Plant," by Mr. John R. Barlow, city surveyor of the City of Montreal, and Second Vice President of this Society.

Mr. Barlow read the following paper:

MONTREAL'S CIVIC ASPHALT PLANT.

BY JOHN R. BARLOW, M. C. S. C. E., CITY SURVEYOR, MONTREAL, CANADA.

The defective condition of many of the asphalt paved streets rendered it absolutely necessary that the city should be in a position to control the situation without being at the mercy of contractors. In the spring of 1903 the city council authorized the Roads Committee to call for tenders for the supply and erection of an asphalt plant and complete equipment. The tender price of Messrs. Warreñ Brothers of Boston, Mass., namely, $13,000, was accepted and the contract awarded in April, 1903. The plant was installed and operations were begun in June of the same year.

The plant's capacity is 1,000 sq. yds. of 2 in. topping per diem. The following is a general description of the plant:

The sand dryers consist of double 40 in. cylinders of 19 ft. 6 in. length, provided with an exhaust fan for furnishing induced draught. These dryers are self-contained, having a steel casing and a double steel roof with air space between to prevent loss of heat by radiation. The inside of the casing is lined half way back with special extra heavy fire bricks and the dryers are fitted with grates having an area of 40 sq. ft. The dryer is so arranged that the heat passes around the outside of the cylinders and then back through the center of them, which allows the heat to come into contact both with the steel shell and through the sand itself, which is kept constantly dropping through the hot gases. The hot sand is elevated by means of a continuous elevator to a revolving screen which can easily be shifted out of the way in case it is desired to run binder.

The bin and mixer are compactly arranged, so that the hot sand or stone can be drawn by gravity into the weighing box and from there into the mixer without having to handle it in any other way. The mixer is elevated so that the teams can back without hindrance.

The whole structure is built of steel, with the exception of the floor, thus securing a perfectly rigid structure which is not affected by shrinkage.

The two melting tanks hold 1,400 gallons each. A most important feature of the plant is the independent trackway which carries the asphalt bucket, by reason of which the jarring and vibration of the machinery is entirely eliminated from the delicate scales on the asphalt bucket and makes it possible to weigh accurately the asphalt for each batch. The power is supplied by a 35 horse power engine. The engine and boiler are mounted together in a room separated from the rest of the plant, so as to avoid damage from dust.

The apparatus supplied by the contractors for the purpose of collecting the dust did not prove to be satisfactory, on account of the large quantity of dust which escaped with the smoke. This dust caused a great deal of annoyance to the workmen and residents in the neighborhood of the plant. In order to overcome the difficulty, the engineer in charge, Mr. N. Cyr, devised and built a steel dust collector which effectively prevents the dust from escaping, and works in a very satisfactory manner. The original dust collector was enclosed in canvas, and the improved dust collector referred to above is made of steel, and the dust and smoke is led into a tank of water where the dust is precipitated by contact with the water.

In addition to the tools necessary for the operation of the plant, the contractors were required to furnish the following tools for street paving purposes:

1 five ton steam asphalt roller
1 tool wagon
1 pitch kettle
6 asphalt rakes
4 asphalt tampers
4 asphalt smoothers
2 [illegible] type asphalt cutters

The whole work of erection was completed in a first class manner by the contractors, and the repairing of asphalt pavements immediately started by the city.

The entire plant, with the exception of the engine and boiler, is under one roof, and the building is quite large, wherein ample quantities of raw material is kept on hand. The city has since acquired an additional melting tank and duplicated all the above named tools, and keeps two gangs of men.

During the first two seasons there were 51,[illegible] square yds. of repairs and new work done by the city; the new work consisted chiefly of repaving streets, formerly paved with 3 in. tamarack blocks which were worn out. The average cost of the asphalt laid was $1.[illegible] per sq. yd., and this figure includes all works in connection therewith.

When the asphalting work is suspended on account of wet weather the old asphalt taken from the streets is ground in a mill and prepared for use in the construction of coal tar composition sidewalks, so that no time is lost.

The city is this year making experiments with different brands of asphalt and hopes by next year to be in a position to determine which kind of asphalt is best suited to the conditions of our climate, and also to be able to ascertain the area that a ton of each kind will cover, together with the cost per sq. yd.

The total cost of the civic asphalt plant, including buildings erected in the corporation yard, tools, repairs, etc., has been to date, $22,881.35.

The approximate total area of pavements of all kinds in the city is 745,228.75 square yards, or 31⅓ miles. Two-thirds of this is now under the city's charge for repairs, and the balance is still under guarantees which expire yearly up to 1910.

In view of the fact that the city now has more than 500,000 square yards of permanent ways to keep in repair, the importance of possessing adequate means to maintain the streets in good repair cannot be exaggerated, and the results obtained with the civic asphalt plant has amply justified the expenditure the venture entailed, as not only has the work been done more economically and promptly, but it has been done in a more thorough and satisfactory manner than when done by contractors.

In conclusion, I am pleased to say that Montreal's civic asphalt plant has proven a big sucess, and if the means are provided, the local press and general public will henceforth have little or no cause to complain of the condition of Montreal's permanent ways.

Mr. Brooke: There is a delegation here from Winnipeg, and as they had the first asphalt plant on the continent, I think it would be interesting for us to hear what they might have to say in connection with the subject.

Mr. Saunderson: We have had an asphalt plant in operation in Winnipeg for about six years, and we lay all our own streets, and do everything for them. We had trouble at the beginning with the contractors. They put up asphalt plants, and of course contrived to charge us what they liked, but now we own our own asphalt plant the same as we do our water works and a great many other institutions of the kind, and are in a better position (I think) than any other city of our size to-day in the country.

Our city clerk is here and I presume he is familiar with the working of the plant, and the saving that has been effected by its operation. Perhaps he could give you some information about it.

The President: There are some other papers which we have to consider, and I think that it would be well for us to get through them first.

The first of them is "A Description of Montreal's Fire Alarm System," by Mr. James Ferns. Mr. Ferns' paper is here, but he has not been able to be present himself. With your permission I will ask the Secretary to read it.

FIRE ALARM TELEGRPH; ORIGIN AND ADVANCEMENT.

BY JAS. FERNS, SUPERINTENDENT, MONTREAL.

Of all the departments of municipal service, there is none which has been the subject of more thoughtful and patient experiment than that of fire alarms, none that has been brought to a higher state of perfection in the last few years. That this should be the case is natural enough. In the old days, when the fire fighter had to do the best he could without the modern contrivances for facing and subduing a conflagration, the fire fiend worked his will, for when once a blaze had obtained a firm grip, and spread to all parts of a building, nothing could save tremendous loss.

It was not from books that the lesson was derived that the secret of success in beating the fiery element lay in discovering the trouble early and getting to work promptly to counteract it. Up-to-date fire engines, all the trusty allies of the present-day fireman even cannot prevent disastrous consequences, unless the brigades have early notification and clear directions as to locality. Of this fact the fire history of the last few years furnishes plenty of examples. The fire alarm telegraph was invented to supply just this need, and it has brought about a revolution.

Though a comparatively modern idea, the fire alarm telegraph has had a phenomenally rapid development. Fifty or sixty years ago no adequate means of locating a fire existed. On the breaking out of a blaze, it took hours to collect the firemen, who were at that time, by the way, volunteers, to the scene of their labors. Buglers were despatched through the town to arouse the citizens, and these, going from street to street, naturally took some time to bring the entire brigade to the rescue. In the meantime the fire was at work, and the result was, as a rule, the entire destruction of the burning premises.

In addition to the length of time required to summon the firemen in this way, another tremendous handicap to the effectiveness of the fire corps lay in the fact that no means existed of guiding the men to the field of action, unless an unusually large blaze could be distinguished. The companies were thus frequently misled, and precious hours wasted.

The origin of the fire alarm telegraph is due to the late Dr. W. F. Channing of Boston, who died in that city in 1901, at the ripe old age of eighty one, having lived to see the idea which he had given to the world brought to its present state of perfection in practice. It was when Prof. S. B. Morse invented telegraphy, and before the system became a commercial success, that Dr. Channing, in 1839, conceived the idea of the fire alarm telegraph. In the month of June, 1845, he presented his scheme to the public through the medium of the Boston press.

At this time, however, Dr. Channing was not a practical electrician, and he found himself compelled to look about for an associate capable of working out the practical details of the movement. In this quest he was fortunate enough to secure the services of Moses J. Farmer of Salem, Mass., who was the practical man, and the inventor of most of the apparatus and instruments of the system. Prof. Farmer was an electrical engineer of rare ability and devised many useful inventions outside of the fire alarm telegraph in the course of his long life.

In his inaugural address, delivered January 3, 1848, Mayor Josiah Quincy of Boston recommended the consideration of the fire alarm system to the city council. It was not, however, until 1851 that affairs took a practical shape, and contracts were signed for the installation of the plant, which, as it can be imagined, was in a very crude form at this early date. However, the work was pushed through, and a fire alarm telegraph for the City of Boston was an established fact, going into operation in April, 1852. The system was then in its infancy, and as it spread to different cities improvements were being constantly introduced, until at present the fire alarm telegraph is as near perfection as it is possible to make it.

Philadelphia was the second city to adopt this municipal improvement in 1856, closely followed by St. Louis, third, in 1858, and Baltimore in 1859. Then came New Orleans in 1860, Charleston, S. C., in 1861, Montreal (the seventh) in 1863, being the first city to adopt the system in Canada. Washington was next in 1864, Louisville, Ky., in 1865, San Francisco in 1865, Chicago in 1865, Cincinnati in 1866, and Quebec in 1867. Other cities followed in rapid succession, and it would be difficult at the present time to discover even a small village that is not equipped in some way with an alarm system.

The importance of prompt fire alarm service is incalculable. The history of every conflagration and every disastrous fire in a large city will show that a delayed fire alarm was one of its chief causes. If the alarms were always received at city fire headquarters immediately after the outbreak of a fire, large fires would be of extremely rare occurrence. With instantaneous alarms universal, it would require most unusual conditions, such as streets blockaded, or the failure of the water supply, to produce either a conflagration or a large fire.

With modern fire apparatus, the time now used in getting out after alarm is reduced to a matter of a few seconds. Human effort has reached its limit in this direction, and there is no room to save even five seconds more, except in getting in alarms more promptly. So in addition to the regular system of street fire alarms, the use of the private alarm system, connected with this, is coming every day into higher favor, and often results in a great saving of property.

In connection with the operating of a fire alarm telegraph service there are certain axioms which cannot but be recognized if the best results are to be obtained. In all cities the central fire alarm office should be in a fireproof building, so situated that there are no fire traps or high building surrounding. For this reason a residential district is preferable. It is to be desired, also, that there should be an open space all around the building.

The alarm boxes should be placed on specially constructed lamp posts on the street corners, each provided with a 16 c. p. lamp, to enable the box to be readily discerned at night. As regards the numbering of the boxes, the "district system," such as has lately been introduced in Montreal and is in use in the largest American cities, is distinctly the best. This system implies a saving of time, as when the first number sounds on the gongs in the stations the firemen know at once whether the call is in their district or not.

When one considers the extent to which the public interest is at stake on the prompt and accurate indication of the fire alarm telegraph the necessity of maintaining this system to the highest degree of efficiency is plainly seen to be of primary importance. A few minutes' delay or irregularity in sounding an alarm may involve a disastrous conflagration. Thus no money should be spared to reduce the chances of derangement to a minimum.

The trend of the modern invention is towards simplicity and accuracy in apparatus, as opposed to the complicated fittings of former years. To this end the old style gravity batteries should be replaced by storage batteries or dynamos, which are at once much more reliable and less expensive. No city can afford to neglect an opportunity of improving its fire alarm service, as this investment is one which never fails to pay.

Another point of importance to be taken into account is the necessity of placing all fire alarm wires in subterranean conduits. Aerial wires should be abolished entirely, a valuable aid to decreasing chances of derangement. In this connection it is but fair that electric companies should give the city the use of their conduits free. In Montreal the fire alarm department has to pay for all the privileges it obtains, while in almost every other city companies are glad to grant the fire alarm service their privileges free. Legislation should be resorted to, if necessary, to compel companies to do likewise in Canada.

As regards the staff of a fire alarm department, much depends on its men being thoroughly competent, sober and reliable. Men who are capable of exercising ability and resource in an emergency should compose such a staff. No fire alarm office should have less than two operators on duty at the same time.

To sum up, the fire alarm telegraph service of a city is one of its most important municipal departments. The lives and properties of the citizens are to no small extent in the hands of this department, and so it is a pressing duty to make every detail of the service as perfect as money can make it.

THE PRESIDENT: We have now a description of the Montreal Water Works System, by Mr. George Janin, superintendent of the Montreal water works. Mr. Janin is not here, but we have his paper, and I will read it to you in his absence.

The President then read Mr. Janin's paper, as follows:

HISTORY AND DESCRIPTION OF THE MONTREAL WATER WORKS.

BY GEO. JANIN, C. E., SUPERINTENDENT MONTREAL WATER WORKS.

The area included in the limits administered by the city corporation is about 6,000 acres, containing a population of about 270,000 souls, not counting any of the large suburban municipalities which are not separated from the city by any natural mark but form part of the city, and would bring, if annexed to the city, as they soon must be, the population to 350,000 souls.

The water supply of the city, with the exception of St. Denis ward, is under the control of the municipal administration, who own the aqueduct and impose a rate for payment. St. Denis ward and the suburbs are supplied from a private company, the Montreal Water and Power Company.

As for all ancient cities, the aqueduct of Montreal had a very modest beginning. Towards 1800 the water from springs was diverted from Mount Royal and distributed through some of the streets of the city in wooden pipes. In 1815 this precarious supply was replaced by a system of distribution of water pumped from the river and raised into tanks containing 240,000 gallons. In 1854 the city bought this system from a private company, after which an epoch of progress began by the construction of a reservoir containing three million gallons and situated at that time outside of the city, at a place called "Cote a Baron." This reservoir now abandoned, has been turned into a fountain for ornament in one of the squares of the city (St. Louis square).

The time had now arrived when the water intake in the river, in the middle of the port, and consequently exposed to all sorts of pollutions, could no more be used with hygienic safety to supply a city full of future promise and anxious for the health of its inhabitants. Since 1847 it had been proposed to take water at the Lachine rapids, above the city, and to make use of these rapids to raise the water, but this scheme and others similar were not considered until 1853, when the city council concluded to confer upon Mr. T. C. Keefer, civil engineer, the duty of studying the plans for an aqueduct able to supply 5,000,000 gallons daily. The study of this project, its examination by consulting engineers, etc., brought the beginning of its execution to the year 1853, and its termination to the year 1854.

The system then established included an open canal four and three-quarters miles long; having its entrance about one mile above the Lachine rapids, at an elevation of 37 feet above the level in the harbor of Montreal. The dimensions of the canal were 40 feet wide at the water surface and 8 feet deep. This canal, throughout most of its course, is actually used to supply the city at present.

At the time of its construction this canal supplied more than sufficient water to develop a hydraulic force of 300 horse power and raise 200 feet above the level of the water in the harbor, 5,000,000 gallons of water, being at the rate of 40 gallons per capita for a population double what it was then (60,000). At the end of that canal were situated the settling basin and the wheel house, about as they stand this day. The hydraulic motive power was utilized by two breast wheels working six pumps to raise the water to a reservoir situated on the slope of Mount Royal, along McTavish street, forming the present low level reservoir, which is but an enlargement of the original one. That reservoir had then a capacity of 15,000,000 gallons.

The whole of this system had been well devised for the quality and quantity of water necessary for a limited future, sufficient in fact for a population double of what it was then, but the rapid increase of population, which has nearly quintupled since, and the inconveniences produced by the severity of our winters on the wheels have necessarily obliged the authorities of the water works to substitute turbines for breast wheels, and also to construct an auxiliary steam plant, with a view of replacing hydraulic power during the low water level times, in a summer and during the winter on account of ice, frasil, etc. The steam plant was also found to be necessary to provide for the insufficiency of the hydraulic force, when the consumption of the water of the city exceeded that for which provision had been made when the canal was constructed.

Meanwhile the population of the city was increasing and was extending itself upon the heights situated east of Mount Royal at an altitude too high to be supplied by the system whose summit was at the McTavish reservoir.

This state of things necessitated the establishment of the present high level system, that is the construction of the reservoir at midway on the mountain slope, and of a pumping station to carry the water from the low level system to the high level distributing service, to a height of 422 feet above the level of water in the harbor. A Worthington steam pump, with a capacity of one-half million gallons was then sufficient to supply the high level system.

In 1878 the low level reservoir (McTavish) becoming insufficient, was enlarged so as to bring its capacity to 37 million gallons. In 1889 the population fed by the high level system had increased so much that a new steam pump of two and one-half million gallons had to be provided for this district.

As the changes were being made to the low level machinery, as mentioned above, several schemes were prepared to place the aqueduct in a way to satisfy the wants of the rapidly increasing population without necessitating the resort to the expensive use of steam. These schemes had in view two objects: the increase of hydraulic power or the supply of water by gravitation. Montreal is not advantageously situated to make use of this last scheme. Built upon an island bordered on one side by the St. Lawrence river, whose width excludes an idea of viaduct or syphon to bring water supply on this side; on the other side it is bordered by a branch of the Ottawa river and adjacent to another island formed by the same river dividing itself into two branches, not so wide as the St. Lawrence river, but of sufficient width to make very expensive the bringing across of a gravitation aqueduct.

To avoid these financial difficulties, nothing was left but to find north of the city a water supply taken at a sufficient altitude, that is more than 425 feet above the St. Lawrence to be adequate to the actual and future wants of the city. The ridge of the Laurentian mountains whose first summit is situated at more than 30 miles from Montreal, was the only spot where a water supply could be found. Explorations and levels were made and established the fact that a water supply could be taken from Lake Ouareau, situated at an altitude of 450 feet and at a distance of about sixty miles from Montreal. But the resumed cost of such an undertaking prevented the further study of it. Consideration of the gravitation plan was consequently superseded by the study of a sufficient hydraulic power system.

In furtherance of this plan, viz.: the extension of the hydraulic plant nature provides for it the head and the volume of water which are necessary; it only remains to utilize these elements for the needs; this is comprised in the plan which the author submitted to the Water Committee in his report of 27th of February last.

This project has been fully studied by many of the superintendents who have preceded the author, and he has done nothing but adopt the principles, only modifying the plans, particularly that one which relates to the bed of the aqueduct.

The plans recommended by the past superintendents all suggest the construction of a new aqueduct 130 feet wide at surface water, 78 feet wide at bottom and 14 feet deep, independent of that which is now in existence, and that the said aqueduct must be maintained for the supply of water during the period of construction, which cannot be estimated at less than three years.

The plan studied by the author and thought out with the help of his assistant, deals with the bed of the existing aqueduct, which will be simply enlarged and deepened, thus avoiding the purchase at the high values of the present time of the land necessary for a new aqueduct. In order to secure the water necessary for the food of the city during the progress of the work, he has provided for the construction of a covered conduit at the side which will supply the water to the pumps during this time, and which, extended to the middle of the River St. Lawrence, will furnish the city good water, purer than that which we now get from the north bank, where it is more or less polluted by the drainage from the riverside lands.

This plan can be carried out for the sum of two million dollars, the interest upon which will be secured by the saving realized over the present system of pumping, and the capital of which the author, as he has shown in his mentioned report, can be repaid in less than fifty years.

The author has the firm belief that a comprehensive plan should at least be studied with care by the aldermen, and as speedily as possible, in order not to be compelled to avoid it by constant new additions to the machinery, or by making terms with a private company and thus losing a part, or perhaps the whole of the control of one of the most important services of the city.

The necessity of the absolute control of the public services is so evident that the larger number of municipalities on this continent as well as the other, are striving not only not to let slip the control they have, but to recover as much as possible any that, by mistake, they have allowed to escape.

DESCRIPTION OF THE WATER WORKS—AQUEDUCT.

As already said, the present source of water supply for the city, is the St. Lawrence river, from which the aqueduct has its entrance one and one-half miles above Lachine rapids, 38 feet above the level of water in the port.

The present aqueduct, from the entrance to the junction of the old aqueduct, has a mean width of 104 feet, and a depth of 14 feet, 4,800 feet long; it is then continued by the old aqueduct, which has a mean width of 30 feet, 8 feet deep and 26,200 feet long. The fall is 5 inches per mile.

The aqueduct ends at a settling basin of a capacity of 1,064,885 cubic feet, used for the distribution of the motive power to the hydraulic engines and for the drawing of the water supplying the city.

At the mouth of the aqueduct, a pier about 1,000 feet long has been built for the purpose of slackening the water and current of the river. Sluice gates, situated at the mouth, and 2 dams with movable gates, situated in the canal, regularize the level thereof; 18 bridges cross the canal and afford the means of circulating on the roads which connect the several portions of the riverside properties.

LOW LEVEL PUMPING STATION.

The water is raised by means of two systems: by hydraulic machines to the extent of about 60 per cent. of the consumption, and by steam engines for the balance.

The structures connected with the low level pumping station are composed of several buildings, of which there are three principal ones; the first contains the turbines operated by the aqueduct water itself, and the system of which comprises four sets of pumps, viz.:

No. 1. A "Jonval" turbine, with two double-acting pumps, which can pump 4,000,000 gallons per 24 hours.

No. 2. A "Samson" horizontal double wheel, with two double-acting pumps and an air reservoir, which can pump 5,000,000 gallons per 24 hours.

No. 3. A "Jonval" turbine, with three double-acting pumps and two air reservoirs, which can pump 3,000,000 gallons per 24 hours.

No 4. A "Jonval" turbine, with two double-acting pumps and an air reservoir; capacity 3,000,000 gallons per 24 hours.

The overflow of the settling basin and the water operating the hydraulic machines fall into a waste weir, below the building, and after a course of about 3,500 feet, flow into the St. Lawrence river, opposite the down stream point of the Nuns' Island.

The second building contains the steam engines, the system of which comprises three sets of pumps, viz.:

No. 1. A high duty "Worthington" engine of a capacity of 10,000,000 gallons per 24 hours.

No. 2. A high duty "Worthington" engine of a capacity of 10,000,000 gallons per 24 hours.

No. 3. A high duty "Worthington" engine (duplex) of a capacity of 8,000,000 gallons per 24 hours.

The third building contains the steam generators, which are composed of two sets of three Heine boilers, and a set of three Lancashire boilers.

The other buildings are used as sheds for the storage of coal and supplies, machine shops and employees' dwellings.

From the pumping station the water is forced into the low level reservoir and into the services by two mains of 30-inch diameter, having together a length of 16,102 feet, and by two 24-inch mains having a total length of 27,709 feet.

One of the 30-inch mains is still unfinished and only branched upon the other of the same diameter, after their passage under the Lachine canal.

The other 30-inch main does not extend as far as the reservoir; at the intersection of McGill College avenue and Sherbrooke street it is connected with the two 24-inch mains which alone go as far as the reservoir; from that point the said 30-inch main extends on Sherbrooke street as far as Delorimier avenue near the eastern limits of the city.

LOW LEVEL RESERVOIR.

The pumps at the low level station raise the water up to the main reservoir of the city situated at the angle of McTavish street and Carleton Road, at the altitude of 204 feet above the river and 165 feet above the intake basin of the low level pumping station.

It is divided into two equal parts by a masonry wall of the same nature as the perimeter walls.

The capacity is 37,000,000 gallons of water.

A building attached to said reservoir contains the valves and sluice gates regulating the distribution and the reserve of water for the section of the city supplied by the low pressure; said section comprising all that part of the city extending from the St. Lawrence river to the following limits (northwards): Sherbrooke, University, Prince-Arthur, Pine avenue, St. Lawrence, Duluth, Cadieux and Mount-Royal streets.

HIGH LEVEL PUMPING STATION.

A building erected on the land adjoining the above-mentioned reservoir contains the high level elevating machines which are composed of a system of two pumps operated by steam.

1. A high pressure Worthington pump (duplex) of 24-horse power and a capacity of one-half million gallons per 24 hours. (This pump is almost unfit for use.)

2. A high pressure Gilbert pump (compound system) of 250-horse power and of a capacity of two and one-half million gallons per 24 hours.

The increase in the population of the high level district still going on, and the necessity to ensure its supply against any uncertainty, led the author to have the city council provide for the installation of a pump of a capacity of five million gallons operated by electro power. When it is in operation, the old steam plant will be kept as a duplicate in case of emergency.

The steam is supplied by a sectional tubular boiler of the Caldwell high pressure type, 200-horse power fed by two American mechanical stokers.

Old boilers of the locomotive type of 120-horse power each are still used during the cleaning, or when accidents take place to the Caldwell boiler.

The pumps take the water in the low level reservoir and raise the same by a force main of 20-inch and 12-inch diameter and 1,674 feet long, passing through McTavish street, Pine avenue, Mt. Royal Park, and ending at the high level reservoir situated on the slope of the mountain, opposite Peel street, at the altitude of 434 feet above the river and 230 feet above the low level reservoir.

As above mentioned a new five million gallons electric pump is in course of erection at this pumping station. It will replace the very old steam plant, which will be completely overhauled and will be kept in good order in case of emergency.

HIGH LEVEL RESERVOIR.

This reservoir is built about in the same way as the low level reservoir. It is composed of only one compartment.

Its capacity is 1,750,000 gallons; it equilibrates the water supply and contains the reserve for the section of the city supplied by the high pressure.

The district so supplied comprises all that part of the city lying north of the limits above mentioned for the low pressure.

CANALIZATION.

In addition to the force mains raising the water into the reservoirs, the canalization of the city is composed of:

28,509	feet	cast	iron	mains	of 30-inch	diameter.
66,198	"	"	"	"	" 24 "	"
13,090	"	"	"	"	" 20 "	"
20,498	"	"	"	"	" 16 "	"
278,120	"	"	"	"	" 12 "	"
121,176	"	"	"	"	" 10 "	"
128,724	"	"	"	"	" 8 "	"
257,758	"	"	"	"	" 6 "	"
324,151	"	"	"	"	" 4 "	"
2,239	"	"	"	"	" 3 "	"
694	"	"	"	"	" 2 "	"
625	"	"	"	"	" 1½ "	"
Total, 1,241,782						

The distribution of water by these mains is regulated by means of 3,082 valves of various diameters.

These mains supply 1,772 public hydrants and 58 private ones.

They are all laid underground, in cuts, with the exception of a portion of the 24-inch force mains, which are contained in an underground gallery on a distance of about 120 feet, from the Carlton Road crossing to low level reservoir.

The water is distributed to the ordinary consumers by free cocks, and to manufactureres, etc., by meters.

In order to complete the description of the system, I will mention the central shops and stores, situated at the corner of St. Chs. Borromee and Lagauchetiere streets, in the center of the city and the secondary shops on Cadieux, Grand Trunk and Desery streets, which provide for the wants of the service in the distant wards.

The President: We also have a paper prepared by Mr. Chausse, Chief of the Bureau of Building Inspection of the City of Montreal, on "Building Regulations." There is not any necessity of my introducing Mr. Chausse to you. He is a gentleman who is well and favorably known to us all.

I have much pleasure in calling upon him to read his paper at this time.

Mr. Chausse: It is true, gentlemen, that I have prepared a paper which I have called "Our Sinful Extravagance, or the Need for Stricter Building Regulations." My voice is in very poor form today, and so I will ask you to let the matter stand over till this evening, say, when I propose to ask this convention to appoint a Special Committee on Fire Proofing and Fire Preventing.

The President: At Mr. Chausse's request we will allow his paper to stand over, so that he may prepare what he wants to present to us.

That finishes our regular order of business for this morning, but perhaps there is some other business that might come before us.

Mr. Chausse: Mr. President, I would move that a special committee, called the Committee on Fire Protection, be appointed by the Society, and that this committee be composed of three members nominated by the President.

According to our Constitution and our general practice we have from time to time appointed special committees like this, and the result has always been beneficial, so far as I know. We need not make it a permanent committee until we see whether the results warrant it. I think that it would be a good thing to give it a trial.

This motion being duly seconded, was agreed to.

Mr. Saunderson: I would like to ask what is the deteriorating effect of sprinkling asphalt pavement, if there is any, or what are the disadvantages?

MR. REIMER: Does the gentleman mean the deteriorating effect to the pavement itself, or does he refer to the effect that the water has on the traffic, and the difficulty of getting over the street?

MR. SAUNDERSON: I mean the effect it has on the material itself.

MR. RUST: I think that it has been proved by experience that water has a very detrimental effect upon asphalt pavements; that is that water is very detrimental to the life of Trinidad asphalt pavements.

We can all remember some few years ago when we started to lay asphalt pavements, the asphalt was laid from curb to curb, and we found that the first part of the pavement to rot was the gutter. This, of course, has been lately overcome by the use of concrete or brick for the gutters.

I do not think that the California asphalts, or the Bermudez asphalts are affected in the same way, or to the same extent that the Trinidad asphalt is.

We found that the best way to clean those pavements was to flush them with water thoroughly. I may say that we do not always do this, on account of the cost, but, we find that that is the most satisfactory way to do the work.

We had been in the habit of keeping the asphalt on some of our principal streets constantly wet. I was opposed to this very much, but the board thought that it was a pretty good thing. They said: "Well, it keeps down the dust, and does not do the pavement any harm, and after all, that is what we want." They did not think of the cost in any manner—I mean the cost of renewing those pavements in a good deal shorter time than they would have to do if they kept them dry.

Then, there is another question, and that is that when an asphalt pavement is wet it is very slippery and dangerous, especially to bicyclists, and in a somewhat lesser extent to horses and pedestrians. Of course that is an important point, but not so important as the other, from one point of view.

I think the engineer from the City of Winnipeg, Mr. Ruttan, has about as much experience upon this subject as anyone I know, and he ought to be able to tell us something about the injury that water does to asphalt.

THE PRESIDENT: Perhaps Mr. Fisher has some data.

MR. FISHER: I thoroughly agree with what has been said by Mr. Rust. We have some fifty-one miles of streets paved with asphalt, about forty of which is Trinidad and the balance the rock asphalt. We find that the water does not have such a deleterious effect upon the rock asphalt as it does upon the Trinidad. We also find that the gutters are the first places to rot, and that they will rot very soon, in fact while the center of the road is still in very good condition.

We have a pavement in our city twenty-one years old and it is in good condition (except for the matter of a few cracks) apart from the gutters. Those gutters have been replaced once, and since then they have deteriorated somewhat, still, the remaining portion of the street is in good condition, and bids fair to last for five or ten years more.

THE PRESIDENT: Was it in your city that a special account was kept two or three years ago showing the gutter as distinguished from the rest of the street? I have an idea that I heard of such a record being kept, and thought it might possibly be in your city.

MR. FISHER: No, sir, it was not in our city. It seems to me that I have heard of such a thing somewhere, but I do not remember just where I heard it, or what place it was.

THE PRESIDENT: I think they found that those three feet of gutter cost about double the cost of the rest of the street, for repairs.

MR. FISHER: We did keep a record of he cost of each street, but it was not in the form you mention.

THE PRESIDENT: I believe this was a special account kept for the purpose of getting some data as to the cost of the gutters compared with the rest of the street.

I suppose all the members are familiar with the fact that several years ago Washington, D. C., found that the gutters were wearing away much more rapidly than the rest of the street, owing to the action of water on the asphalt, and that they replaced the asphalt with brick for the gutters.

We were to have a paper by Mr. Dow, of Washington, on this subject, but I am sorry that he has not found it possible to be here. Nor have we received his paper. I hope, however, that we will receive it in time to incorporate it with the rest of the papers in the Proceedings.

MR. FISHER: Perhaps Mr. Tillson could add something to what has been said?

MR. TILLSON: I think that Mr. Rust has said about all that there is to be said on the subject. As to the question whether or not water has a deleterious effect upon asphalt, I should say that it depends altogether upon the kind of asphalt you have reference to. It is a well known fact that Trinidad asphalt will be more acted upon by water than will any other kind.

In Brooklyn we do not think it is necessary to lay a special gutter for an asphalt pavement. The feeling there is so strong against it, that where a street has been ordered curbed and guttered previously with some other material, the property owners have wanted us to take up the other gutter and lay one of asphalt instead.

Then the question of the grade of the street is going to make a difference. I do not think that water will do asphalt any harm if it simply flows over it. It is the standing water that does the damage. There is also another factor, and that is whether they keep the street clean or not, because if the street is not kept clean, whatever is on the pavement will collect the water and keep it damp.

As a matter of fact it is nearly always in the gutters that you will find the water standing, and you will also find that portions of the street are always covered with water if the street is sprinkled frequently. I may tell you that in Brooklyn none or the asphalt streets are sprinkled, except in a few cases where it is done by the property owners.

The first case that I knew of where asphalt was injured by dampness rather than by water (and this has made me feel all the more certain in my opinion on the matter) was in Omaha, Neb. In this case there were no surface water sewers, and all the water had to be carried across the intersecting streets. One gutter was paved with asphalt and then kept covered, and practically damp all the time. Three or four years after that street was paved the cover of this gutter was taken off, and the asphalt pavement underneath was found to be entirely disintegrated. You could take the asphalt and crumble it up between your fingers, while the asphalt that had been exposed to the air and kept reasonably dry, was in good condition and remained so for fifteen years afterwards.

All this enables me to say in answer to Mr. Saunderson's question that if a street is kept clean, with reasonable care sprinkling will not do any material harm, but, if the street is dirty, and if the gutters are dirty, or if the grade of the street is such that the water from the sprinkling is liable to stand on the street, then it will materially damage it.

Mr. Saunderson: I value this information very much, gentlemen, and thank you sincerely for it.

Mr. Sherrerd: I would like to ask that the Society increase the salary of the Secretary. When the Association was first formed there was very little money in the treasury, but now that we are on our feet we ought to be able to do better by our Secretary than we were at that time. If it is in order I will make a motion to that effect.

The President: We intended to spring that as a sort of a surprise upon the Secretary, but if Mr. Sherrerd wishes to present the motion now, why it will be all the same.

Mr. Sherrerd: I did not know that the matter was under consideration, and thought that I would bring it before the meeting. Of course if the matter is being considered, I am quite willing to leave it in your hands. I know that it will be properly dealt with.

The President: Is there any other business that should come before us at this time?

If not, I will declare this session adjourned, to meet again this evening at 8 o'clock.

The session thereafter adjourned.

FIFTH SESSION.

The meeting was called to order at 8:10 P. M., Thursday, September 7th. The President, Mr. Folwell, in the chair. He said:

The first order of business this evening is the report of the Committee on Water Works and Water Supply. Mr. D. W. Mead is chairman of this committee, but I do not think he is here, and I have not received his report, so I think we had better let it stand and pass on to the next item, which is a very interesting paper on the "Purification of Water by Copper Sulphate," by Mr. Daniel D. Jackson. Mr. Jackson has not found it possible to be here to read the paper personally, but I think it would be as well to ask the Secretary to read it. I understand that it is a very interesting paper on a very interesting subject.

The Secretary read Mr. Jackson's paper, as follows:

PURIFICATION OF WATER BY COPPER SULPHATE.

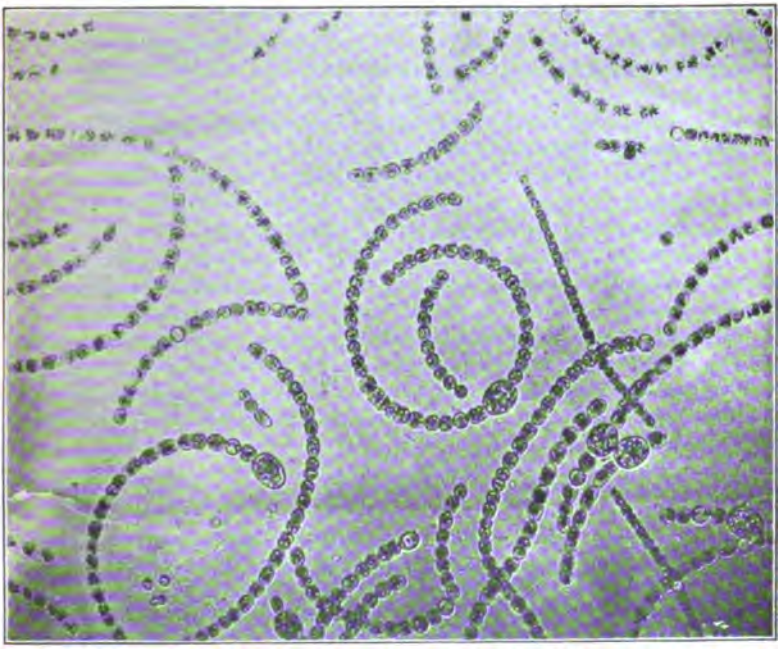
BY DANIEL D. JACKSON, NEW YORK CITY.

Bacteriologist Department of Water Supply, Gas and Electricity.

A wide interest has been aroused in the subject of copper sulphate treatment since the publication on May 7th, 1904, of Bulletin No. 64, by Moore and Kellerman of the Bureau of Plant Industry, United States Department of Agriculture. In this Bulletin entitled, "A Method of Destroying or Preventing the Growth of Algae and Certain Pathogenic Bacteria in Water Supplies," the authors showed that growths of odor-producing organisims in water could be easily destroyed by means of copper sulphate in quantities so small as to have absolutely no physiological effect, even if the copper used should entirely remain in the water supply. They also showed that all or nearly all of this copper is precipitated together with the microscopic growths to the bottom of the reservoirs so treated.

The first experiments of the writer on the treatment of water with copper sulphate were made upon Baiseley's pond, Jamaica, L. I., on September 6th, 1904. As all of the water used from it is subsequently filtered, it was considered that there could be no possibility of the presence of copper sulphate after filtration, as this chemical does not remain in solution in the water, but is immediately precipitated by the carbonates present. At the time of treatment the pond contained a considerable growth of anabaena. On account of its gelatinous nature this organism was giving great trouble in the mechanical filters and had at times caused a reduction of as high as 25 per cent. in the rate of filtration.

The accompanying illustration gives a magnification of this growth 285 times and shows how it is able in large numbers to clog up the surface of a filter.



ANABAENA CIRCINALIS.

The treatment of Baisley's pond was made as usual by rowing back and forth over the surface in a rowboat and dragging on each side of the boat a bag containing the copper sulphate. This chemical dissolves in the water with just about the proper rapidity to allow a boat to be rowed at an ordinary rate, and the solution spreads out and sinks, thus coming in contact with practically all the water in the pond.

The following table gives the results obtained:

REDUCTION OF ALGAE IN BAISLEY'S POND DUE TO COPPER SULPHATE TREATMENT.

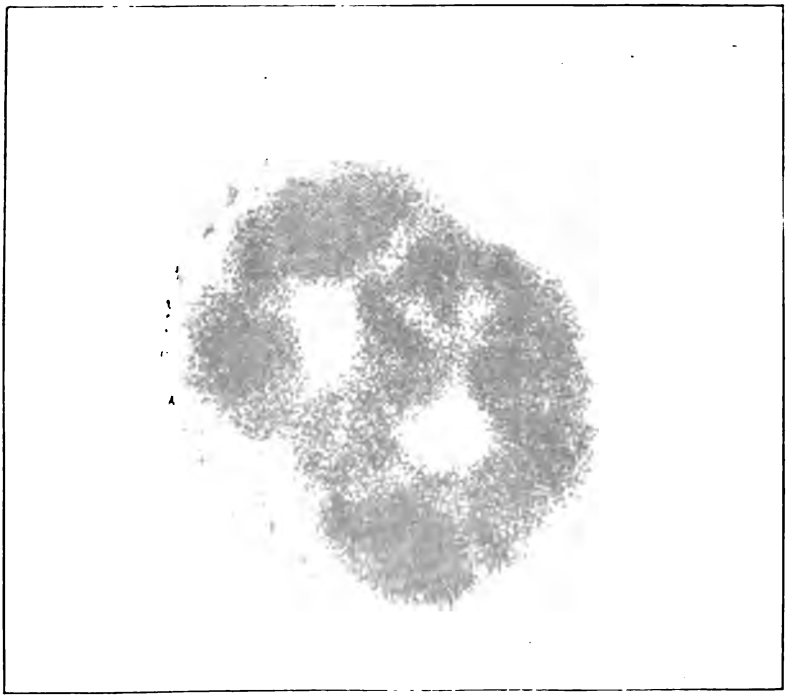
Date, 1904.	**Location.**			**Total Organisms.**	**Anabena.**
Sept. 6,	Top	before	treatment	1,640	800
“ 6,	Bottom	“	“	435	265
“ 7,	Top	after	“	155	55
“ 7,	Bottom	“	“	235	0
“ 8,	Top	“	“	105	0
“ 8,	Bottom	“	“	150	0
“ 9,	Top	“	“	125	0
“ 9,	Bottom	“	“	125	0
“ 10,	Top	“	“	175	0
“ 10,	Bottom	“	“	105	0
“ 30,	Top	“	“	140	0
“ 30,	Bottom	“	“	100	0

It will be seen from the above figures that the treatment was highly successful, and that on the second day the total microscopic growth was greatly reduced, while the organism which caused the trouble was completely removed. The amount of copper sulphate used was approximately equal to one (1) part in eight (8) million parts of water, and the expense of treatment for 100,000,000 gallons was $7.50.

On the third day after treatment the wash water of the filter was reduced to three (3) per cent, causing a saving in the yield of the plant for that item of one million gallons per day.

Through the kindness of Commissioner Kennedy and Superintendent Zartman of the Department of Parks of Brooklyn, copper sulphate experiments were next made on an extremely heavy growth of Clathrocytis, an organism closely related to Anabaena, and one which is often found in large quantities in surface waters. This microscopic growth occurred in the Prospect Park duck pond, near Flatbush avenue, Brooklyn, in such enormous amounts as to entirely cover the surface of the pond with a thick green slime.

The illustration below is a photomicrograph of the organism magnified 175 times.



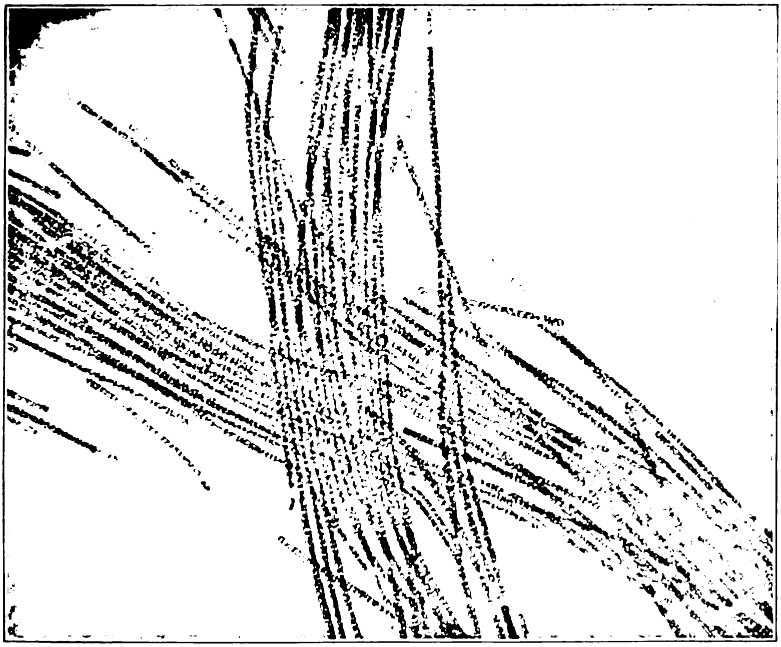
CLATHROCYTIS AERUGINOSA.

The following table gives the results obtained by the treatment of this organism.

REDUCTION OF ALGAE IN PROSPECT PARK DUCK POND DUE TO COPPER SULPHATE TREATMENT.

Date.	Location.			Units of Clathrocytis.
Sept. 9,	Top	before	treatment	700,000
" 9,	Bottom	"	"	10,000
" 10,	Top	after	"	620,000
" 10,	Bottom	"	"	83,000
" 11,	Top	"	"	94,000
" 11,	Bottom	"	"	35,000
" 12,	Top	"	"	7,625
" 12,	Bottom	"	"	2,550
" 13,	Top	"	"	560
" 13,	Bottom	"	"	640

The amount of chemical used was approximately one (1) part in four (4) million parts of water, and the cost of treating the pond was $2. On the second day after treatment the microscopic growth had been greatly reduced, and that which remained appeared to be dead. On the third day the pond was perfectly clear and the microscopic growth reduced to such



APHANIZOMENON FLOS-AQUAE.

an extent as to be unobjectionable. During the present summer this treatment has been extensively used in the Brooklyn Department of Parks and has been found to effectually remove the disagreeable odor and unsightly appearance occurring so often in the park ponds, and in the dilutions used there has not been the slightest injury to shrubbery or fish.

During the month of September, 1904, a considerable growth of an alga known as Aphanizomenon occurred in one of the sources of water supply for the Borough of Manhattan and its presence was the cause of a considerable taste and odor in the water.

A photomicrograph of this organism, magnified 285 times, is given above:

On Friday, September 30th, the surface of this reservoir was treated with copper sulphate in the proportion of one (1) part to eight (8) million parts of water. This amount of copper sulphate, providing it all remained in the water, would necessitate an individual to drink one hundred gallons of water a day to get the slightest physiological effect from the copper, and there is, therefore, no question about the safety of such a treatment as this, especially as only one or two treatments a year are necessary.

The following table gives the results obtained:

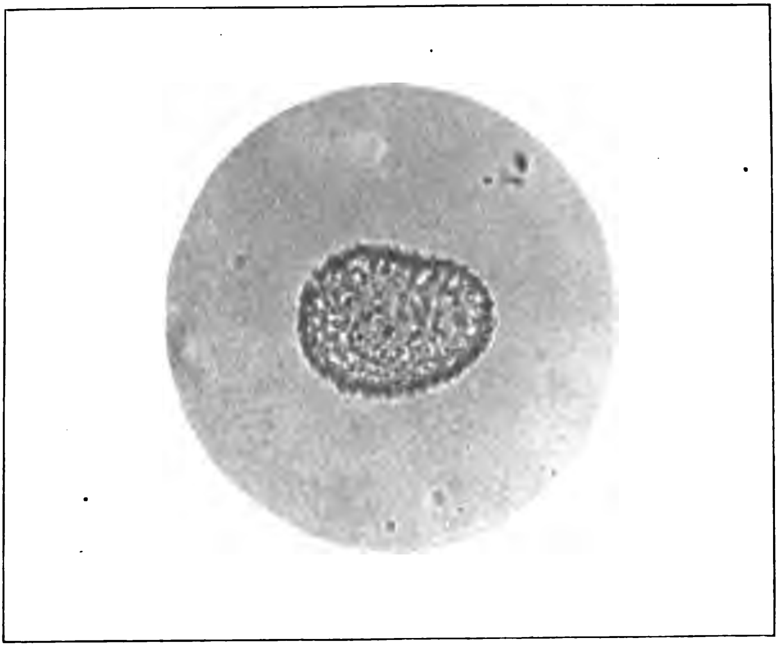
REDUCTION CF ALGAE DUE TO COPPER SULPHATE TREATMENT.

Date.	Location.		Total Organisms.	Aphanizomenon.
Sept. 30,	Top	before treatment	4,680	4,100
" 30,	Bottom	" "	4,115	3,725
Oct. 1,	Top	after "	1,020	755
" 1,	Bottom	" "	565	285
" 2,	Top	" "	490	240
" 3,	Top	" "	140	0
" 3,	Bottom	" "	275	0

The figures of the above table show that this form of blue-green alga was completely removed on the third day after treatment. From that time on the water has been clear and free from unpleasant odors.

Later in the year the microscopic organism uroglena occurred in large numbers in one of the Brooklyn supply ponds. This organism produced a strong fishy taste and odor in the water, and considerable numbers were being transported to the Ridgewood and Mt. Prospect distributing reservoirs. In order to prevent any further influx into the reservoirs of this odor-producing organism, the pond was shut off and a treatment with copper sulphate was made on November 23, 1904. As this is an extremely delicate organism, a dilution was used of only one (1) part of copper sulphate to twenty (20) milion parts of water.

The illustration below is photographed of this organism taken through the microscope and magnified 125 times:



UROGLENA AMERICANA.

The following table gives the remarkable results obtained:

REDUCTION OF UROGLENA DUE TO COPPER SULPHATE TREATMENT.

Date.	Uroglena (Units per cc.)
Nov. 23, before treatment	1,100
" 25, two days after treatment	450
" 27, four " " "	0

The figures show that the fourth day after treatment no trace of the organism remained. During the present year no trouble has been experienced from microscopic growths in this pond.

In the spring of the present year one of the Brooklyn sources of supply was treated with copper in order to remove a growth of asterionella. It was found that one part of copper sulphate in three million parts of water was necessary. The following table shows the results obtained:

REDUCTION OF ASTERIONELLA DUE TO COPPER SULPHATE TREATMENT.

Date.	Asterionella.
May 2, before treatment	2,850
" 3, " "	3,400
" 4, " "	3,650

Date.	Asterionella.
May 5, after treatment	2,450
" 6, " "	2,350
" 7, " "	2,200
" 8, " "	1,275
" 9, " "	875
" 10, " "	640
" 11, " "	550
" 12, " "	380
" 13, " "	310
" 14, " "	260
" 15, " "	200
" 22, " "	25

It will be seen from the above figures that not only does asterionella require more copper for its removal, but the reduction in the organisms appears to take place much more slowly.

AMOUNT OF COPPER NECESSARY FOR TREATMENT.

The amount of copper required to remove a growth of micro-organisms from water depends to a large extent upon the structure of the particular organisms present. A definite amount of copper is required each time the treatment of any particular genus is made, excepting when the growth is extremely heavy, when it may be even necessary to double the quantity. In general the amounts of copper so far found to be required are as follows:

DIATOMACEAE.	
Asterionella	3,000,000
Melosira	3,000,000
Synedra	3,000,000
Fragilaria	4,000,000
CYANOPHYCEAE.	
Coelosphaerium	4,000,000
Oscillaria	5,000,000
Microcystis	6,000,000
Anabaena	8,000,000
Aphanizomenon	8,000,000
Clathrocystis	8,000,000
CHLOROPHYCEAE.	
Draparnaldia	3,000,000
Scenedesmus	3,000,000
Conferva	3,000,000
Raphidium	3,000,000
Closterium	3,000,000

Volvox	4,000,000
Spirogyra	5,000,000
Hydrodictyon	10,000,000

PROTOZOA.

Chlamydomonas	2,000,000
Cryptomonas	2,000,000
Euglina	2,000,000
Glenodinium	2,000,000
Peridinium	2,000,000
Mallomonas	2,000,000
Dinobryon	3,000,000
Synura	10,000,000
Uroglena	20,000,000

It will be seen from the results that if the nature of the growth is not known that a treatment of one part in two million parts of water will be sufficient to accomplish the work. If, however, the organism is known a much smaller amount may in most cases be used.

RECURRENCE OF GROWTH.

It sometimes happens that a short time after a pond has been treated, and the growth removed, a second growth will develop. This second growth may be the same organism as the first, or it may be an entirely different organism. The fact that a second or third growth sometimes develops is in no way remarkable when we consider that the copper added usually precipitates to the bottom in a few days and becomes inactive in the water above. If the conditions are favorable for a second development there is nothing but the reduction of spores to prevent its occurrence, but it has been noted that it is only in ponds or reservoirs highly contaminated with organic matter, and having large deposits of muck at the bottom, that such repeated growths do occur. In such cases if the ponds are not cleaned it may be necessary to treat them four or five times during the year. It has been claimed that a pond once treated with copper sulphate will require a stronger treatment for the second growth. This has not been the experience of the author.

INFLUENCE OF COPPER ON BACTERIA IN WATER.

When a heavy growth of algae is destroyed by treatment with copper, the dead organisms furnish food for the development of bacteria, and unless the algae are rapidly precipitated to the bottom of the pond, then with the fall in algae comes a marked rise in bacteria. Water bacteria require very strong solutions of copper to produce the slightest effect upon them. The following table shows the effect upon the common water bacteria produced by the treatment of copper (one part in 3,000,000 parts of water) in a reservoir containing asterionella:

1905.		Microscopic Organisms.	Bacteria.
March 13,	before treatment	4,625	405
" 14,	after "	3,645	600
" 15,	" "	3,325	6,000
" 16,	" "	1,925	11,000
" 17,	" "	1,850	12,000
" 18,	" "	1,575	45,000
" 20,	" "	1,350	100,000
" 21,	" "	900	440,000
" 22,	" "	350	630,000
" 23,	" "	350	310,000
" 24,	" "	400	107,000
" 25,	" "	360	80,000
" 26,	" "	300	64,000
" 27,	" "	270	50,000
" 28,	" "	150	37,000
" 29,	" "	100	20,000
" 30,	" "	100	8,000
" 31,	" "	60	3,500
April 1,	" "	25	860

EFFECT OF COPPER ON TYPHOID BACTERIA.

Experiments by the author show that the Baccilus Coli communis and the Bacillus Typhi abdominalis of the attenuation usually found in water are both destroyed by copper sulphate in the proportion of one part to two million parts of water. But these results are not obtained when fresh virulent typhoid germs are added to water. A strength of one part to 50,000 parts of water is then required.

In case of an epidemic, the latter strength is the only one which would be sure of accomplishing absolute disinfection, while the smaller amount would attenuate virulent typhoid or kill attempted typhoid. The strength of one to fifty thousand would give a noticeable taste and be likely to produce a physiological effect upon the consumer and is not to be recommended. It is probably that a treatment of such contaminated waters in a strength of one part in one million will sufficiently attenuate the typhoid germs so as to render them much less dangerous, and will at the same time be dilute enough to prevent any physiological effect upon the consumer. In solutions of double this strength a slight taste is noted, as has been pointed out by Weston.*

This is an added reason why it is not advisable to treat a water used for drinking purposes with amounts stronger than one part in one million parts of water.

1. The treatment of park ponds and water supply reservoirs with copper sulphate has now been demonstrated in hundreds of places through-

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*Journal of the Massachusetts Association of Boards of Health, Vol. XIV, No. 8, August, 1904.

out the country to be a satisfactory and thoroughly practical method of removing green growths which produce an unsightly appearance or a disagreeable taste and odor.

2. The amounts required depend upon the structure of the organism present, and, to some extent, upon the amount of the growth. An extremely heavy growth may, in some cases, require double the amounts given in the table.

3. One part in two million is sufficient for the removal of all the objectionable growths, and if the genus is known, a much less quantity may usually be employed.

4. Virulent fresh typhoid requires one part of copper to 50,000 parts of water to kill the germs, but amounts greater than one part per million can be detected by taste in the water and if taken constantly would be likely to produce a physiological effect upon the consumer. In cases of epidemic from typhoid fever from water supply the disease bacteria may be greatly attenuated and rendered much less dangerous by treatment of one part of copper to one million parts of water.

MR. SHERRERD: I was asked to move that the matter of the exhibits at the next annual convention of this Society be placed in the hands of a committee of say three corporate and four associate members, the understanding being that when any question of importance arises the unanimous vote of the three corporate members against it would defeat it. The associate members ask for the extra representation only in order that they may have a working force.

It seems that under the arrangements here that the associate members had to pay quite a large sum for their space in the Association hall, of which the Society received but five per cent. They think that things could be so arranged that the expense to the associate members would be much less, and that the Society would get more benefit out of it.

I would therefore move that a committee be appointed to have charge of the Birmingham exhibition, and that this committee consist of three corporate members and four associate members; that there shall be no debts contracted by the committee in the name of the Association.

THE PRESIDENT: This matter has already been considered by the Executive Committee, and it was generally understood that the committee should have charge of the exhibition, and should contract no debts in the name of the Society.

Mr. Sherrerd's motion being duly seconded, was carried.

THE PRESIDENT: A temporary committee has already been appointed in an entirely informal manner. They had no idea that they were recognized by the Society as a committee. Perhaps it would be as well for the associate members to select their own representatives, and the Society can select the corporate members.

Three corporate members have already been appointed to act with the associate members on this temporary committee to which I have referred. I will therefore appoint those three members as the corporate members on the committee suggested by Mr. Sherrerd.

MR. SHERRERD: With reference to Mr. Jackson's paper, I would like to make one remark. The author has intimated that it is not advisable to depend upon copper treatment to remove pollution from water. There has been a tendency on the part of some advocates of the use of copper sulphate that it would be a very good thing to use on polluted waters. I understand, however, that the repeated treatment of the water with copper sulphate is apt to be dangerous to a community using the water.

I simply wished to make this statement so that it might accompany the paper in the proceedings. I want to emphasize the fact that no city should rely upon the copper treatment for the removal of pollution from the water. It has been said that it might be used in that way, but its legitimate use seems to be confined to the removal of algae and organisms of that nature.

THE PRESIDENT: I might say that from what I know of the subject it is not necessarily highly efficient in removing even algae. It kills them, but they stay on the bottom.

MR. SHERRERD: And when the treatment is discontinued I understand that they are likely to come back again.

THE PRESIDENT: And sometimes they do not settle on the bottom. I have know of one case where they were certainly killed, but they did not settle, but stuck all along the shore. I admit, however, that the fact that they settle along he shore prevents them from getting into the intake, but it gives the place a bad appearance.

I wish to announce to you that an oversight has been called to my attention. I stated that a committee had been appointed to take charge of the exhibits, but I did not nominate the committee. I will therefore appoint Messrs. Wm. S. Crandall, R. K. Davis, E. J. Snow and T. H. Blair as the associate members, and Messrs. Tillson, Sherrerd and Rust as the corporate members.

Our next business is to hear the report of the Committee on Sewerage and Sanitation. Mr. E. S. Rankin is the chairman of this committee, and if he is ready we would like to hear the report.

Mr. Rankin then presented the committee's report, which was as follows:

REPORT OF THE COMMITTEE ON SEWERAGE AND SANITATION.

A REVIEW OF THE ANTI-MOSQUITO CAMPAIGN, WITH SPECIAL REFERENCE TO THE WORK IN NEW JERSEY.

It had been the intention of the Committee on Sewerage and Sanitation to present at this Convention a general review of the sanitary work now being done in the United States and Canada, leaving the field open for papers on specific subjects to other members of the Society.

Among the papers which it was expected to present was one on mosquito extermination, by Dr. John B. Smith, State Entomologist of New Jersey, who has spent the larger part of his time for the past three years in the study of this subject and in the practical work of extermination. When it was found that Dr. Smith would be unable to attend the convention, it seemed to the chairman of the committee that the sunbject was of such importance and was exciting such widespread interest at the present time that a report dealing with this question alone might prove of more interest than the more general report at first intended.

The writer does not claim to be an expert on this subject, nor does this report contain any original ideas. For the information contained herein I desire particularly to express my indebtedness to Dr. Smith, and also to Mr. Henry Clay Weeks, Secretary of the National Mosquito Extermination Society.

Not more than four years ago the announcement of such a subject would probably have been greeted with a general smile of amusement, but since it has been established beyond question that yellow fever is carried by the Stegomyia and malaria by the Anopheles mosquito, and believed by most authorities that these diseases are transmitted only by this means, the seriousness of the subject is being recognized. The press almost universally is taking up the matter, extermination societies, both local and national are being formed, and boards of health, city and state legislatures are passing ordinances and laws, bearing on the subject.

It is not the purpose of the writer to go into any detailed description of the several varieties of mosquitoes or their habits further than to say that there are at present about five hundred known species, about forty of those are found in New Jersey. Many of these species are rare and cannot be considered as pests. Some are not even able to bite, but this failing is more than made up by other members of the family. A few important differences in their life habits may be noted, as for example, some species winter in the adult stage, others as larvae, and still others as eggs. Some habitually enter houses, others rarely, except by accident. Some never fly more than a few hundred feet, while others may be found in swarms ten, twenty or even fifty miles from their breeding places. This last mentioned point is important from the fact that while a given locality may be entirely free from local broods, it may at certain times be infested with swarms from other localities over which it has no control. This materially complicates the problem and makes it more than a local question. So far as is now known only two species are disease carriers.

However the different species may vary in their habits, in one very important feature they all agree; they all require standing water for one stage of their development. The proposition, therefore, resolves itself into this—get rid of standing water and there can be no mosquitoes. In other words, the solution of the problem lies in the filling or drainage of swamps and marshes and stagnant pools and the avoidance wherever possible of cisterns, rain barrels, cesspools, etc. Where these latter are a necessity they should be screened or oiled. Running water, except where the edges are very shallow and overgrown with grasses, and waters containing fish are not dangerous.

Notwithstanding the fact that the relation of malaria to mosquitoes had been suggested more than twenty years before and that in scattered localities at widely separated points petroleum had been successfully used to kill larvae, it was not until the publication of Dr. Howard's book on mosquitoes, in 1901, that the movement became in any way general, or that anything like a systematic attempt at practical extermination was undertaken.

At the present time the movement may be said to be world-wide. In the United States practical work is being done in New York, New Jersey, Massachusetts, Connecticut, Delaware, Maryland, Florida, Alabama, Louisiana, Texas and California. There may be other states from which I have no report. To mention a few specific instances, New York City has appropriated $17,000 for dealing with the salt marshes on Staten Island. Breeding places around Gravesend Bay are being filled with the city ashes and refuse. Very successful work has been done along the north shore of Long Island. The accompanying circular from the New York City health department is a good example of brief and concise rules for neighborhood work. It was published with special reference to the Sheepshead Bay movement and was distributed by the police throughout the whole district.

(Circular.)

DEPARTMENT OF HEALTH

CITY OF NEW YORK.

Resolutions of the Board of Health, New York City, in aid of Mosquito Extermination and the Prevention of Malarial Fever.

(In force from April 15, to October 15.)

1. No rain water barrel, cistern or other receptacle for rain water shall be maintained without being tightly screened by netting, or so absolutely covered that no mosquito can enter.
2. No cans, pails or anything capable of holding water, shall be thrown out or allowed to remain unburied on or about the premises.
3. Every uncovered cesspool or tank shall be kept in such condition that oil may be freely distributed and flow over the surface of the water. Covered cesspools must have covers perfectly tight and all openings screened.
4. No waste or other water shall be thrown out or allowed to stand on or near the premises.

☞ Information is requested of any standing water that the premises may be inspected and the legal remedies against same be applied.

The prompt co-operation of all persons in the enforcement of the above regulations is earnestly requested, and they are assured that in this way the breeding of mosquitoes on their premises will be prevented.

Mosquitoes are the only proven means of conveying malaria.

Any inquiries or complaints in relation to the above matter should be forwarded to

JOSEPH H. RAYMOND, M. D.,
Assistant Sanitary Superintendent,
Borough of Brooklyn,
38-40 Clinton Street.

HERMAN M. BIGGS, M. D.,
Medical Officer.

ERNST J. LEDERLE, Ph. D.,
President.

A somewhat more elaborate circular is published by the health department of Stamford, Conn., giving cuts of the ordinary and the malarial mosquito, with brief descriptions of the same, and rules for preventing breeding.

Along the shores of San Francisco Bay a settlement of the wealthier citizens was about to be abandoned on account of the swarms of mosquitoes. The marshes were drained and the pest practically eliminated.

The work in New Orleans is a matter of current history and need be no more than mentioned.

Special mention should also be made of the educational campaign being conducted by the National Mosquito Extermination Society, an association now in its third year of existence, composed of representative men, entomologists, physicians and engineers from all over the United States.

The work of the United States government at Havana was an object lesson to the world. How successful this work was is evidenced by the fact that in 1902 for the first time in two centuries the city was without a single case of yellow fever, and in the three years from 1900 to 1903, deaths from malaria were reduced from three hundred and twenty-five to forty-five. It is confidently expected that the similar work now being done in Panama and New Orleans will prove equally effective. Another remarkable instance of a successful crusade was at Ismailia on the Isthmus of Suez, where in one season's work cases of malaria were reduced from two thousand to two hundred. Among other governments which have interested themselves in the work may be mentioned Great Britain, Germany, Italy, and, of course, Japan. The Republic of Cuba is continuing the work begun by the United States. So far as I have been able to learn no active interest has yet been taken in the movement by the country, whose hospitality we are enjoying today, but perhaps among your other blessings you enjoy immunity from this pest.

The State of New Jersey has long been noted among her sister states as the chosen dwelling place of the mosquito. While this reputation is undeserved, other sections of the country suffering to a much greater extent, she certainly can claim the credit of being the pioneer in the movement toward their extermination. In 1902 the state legislature passed a law appropriating the sum of ten thousand (10,000) dollars for the study of the life habits of the insect and the devising of means for its extermination. On its introduction, the bill was looked upon as a joke and referred to the Committee on Agriculture with no thought, except among its few advocates, that it would ever be heard from again. However, after hard work on the part of the men back of it, it was finally passed. This $10,000 was spent in a thorough study of the subject by the state entomologist, and his report, a volume of four hundred and eighty-two pages, is now the text book for students of the question all over the country. A supplement to this act, passed the following year, gives to local boards of health authority to condemn as nuisances all mosquito breeding places and to compel the owners of such places to abate the nuisance. Still another act passed at the last session of the legislature provides for the investigation of breedings places, and recommendations for doing away with the same by the director of the State Agricultural Experiment Station on the request of the proper municipal authority; and in case such breeding places are found to be on salt marshes, for state aid in draining the same to the extent of twenty-five per cent. of the cost of the required work. The bill carries an appropriation of $16,000 to run over two years, $6,000 of which is for investigation and experiment and $10,000 for the state aid feature.

Among the first municipalities in the state to systematically take up the campaign was the village of South Orange. I cannot do better than to introduce at this point the circular issued by the Drainage Committee of the Village Improvement Society. It shows in the fewest possible words just what has been accomplished, and is also interesting as an educational exhibit.

(Circular.)

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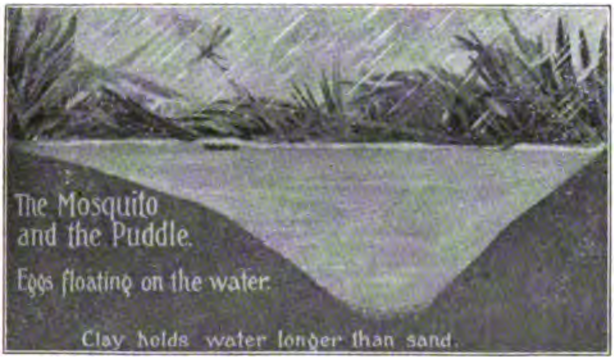
INFORMATION ABOUT MOSQUITOES.

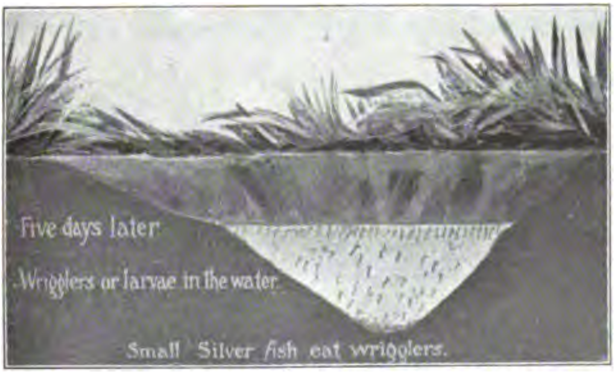
ISSUED BY THE DRAINAGE COMMITTEE OF THE

VILLAGE IMPROVEMENT SOCIETY OF SOUTH ORANGE, N. J.


The Mosquito
and the Puddle.
Eggs floating on the water.
Clay holds water longer than sand.

This mosquito has just laid from 150 to 400 eggs.

If the sun does not dry up this pool before ten days, or if no one fills the pool with earth nor drains it, or if oil is not put on the surface of the pool, then about 150 to 400 mosquitoes will be bred from this pool in about ten days. In cool weather mosquitoes breed less rapidly than in warm weather.


Five days later.
Wrigglers or larvae in the water.
Small Silver fish eat wrigglers.

The eggs have become "wrigglers" or larvae. "Wrigglers" may be seen with the naked eye. The "wrigglers" at the bottom are feeding, those at the top are breathing.

Oil on the water would prevent the "wrigglers" from breathing and they would die in a few moments. The sun has evaporated half of the water. Without water the "wrigglers" would die. Mosquito larvae are scavengers; a foul pool breeds more than a clean one.

In about five more days.
Mosquitoes issuing from the water
The nearer one lives to stagnant water the more the mosquitoes will annoy him

THE MOSQUITOES WIN.

The sun failed to evaporate the water. The pool was neither filled, drained nor oiled.

"Wrigglers" become pupae for at least two days before they became mosquitoes. Any receptacle holding water for ten days may breed mosquitoes; for example, barrels, tin cans, cesspools, culverts, manure pits, etc.

It will pay any one to abolish standing water near his home.

NOTE—The above illustration is a correct representation of the breeding of the commonest of our domestic mosquitoes, *(Culex pipiens)*. The story of one puddle is the story of a million puddles. The sun may usually be depended upon to dry up the great majority of such puddles before ten days elapse.

SOME FACTS ABOUT MOSQUITOES.

1. There are over 30 species of mosquitoes in this part of the United States.

2. Different species have different habits, as do different birds and fowl.

3. Some species are domestic—breeding in fresh water, flying short distances and habitually entering houses. Others are migratory, flying long distances, and almost never (except accidentally) entering houses. The latter are occasionally seen in South Orange. Most migratory mosquitoes breed in salt water marshes.

4. All mosquitoes breed in stagnant water and require from one to three weeks to transform from eggs to winged mosquitoes.

5. The common house mosquitoes *(Culex pipiens)* are the most abundant of domestic mosquitoes.

6. The Malarial mosquitoes *(Anopheles)* may breed in any sort of receptacle or puddle holding water, and are the most dangerous domestic

mosquitoes. They never travel far from their breeding place. Ross, an eminent authority, says 600 yards is about the limit.

7. Mosquitoes do not breed in the grass, but tall grass forms a favorite harboring place. A mosquito a day old is full grown—females three days old may lay eggs.

8. Salt marsh mosquitoes breed 4½ miles southeast and 5 miles east of South Orange; these were present about 10 days during 1903. About August 2nd to 5th with four days gentle east wind the marsh mosquitoes were very numerous in the fields and gardens for about five days. They were not noticed by most people because they did not seek to enter houses. They were also present July 5th to the 10th. The Newark and Elizabeth salt marshes are now being drained.

THE WORK OF THE DRAINAGE COMMITTEE.

1. In 1901 we oiled every stagnant pool in the village. The mosquitoes were so greatly reduced in numbers that we were satisfied that our supply was chiefly of local origin. It was especially noticeable that they were very scarce in houses in the fall. We expended about $1,000 during the season, but not a dollar for permanent improvement.

2. In 1902 we did some draining, filling of holes and oiling what stagnant water we could not abolish. The results were emphatic. We expended about $1,200—one-half of this sum was for permanent work.

3. In 1903 we abolished more than half the wet places in the village, while the Board of Health did the oiling. The eighteen days continuous rain fall in June and the twelve days rain fall in August produced abundance of mosquitoes in towns and villages where they are seldom seen. Towns normally mosquito-less had a pest in 1903. South Orange suffered like the others, but for a far shorter time than those towns where anti-mosquito measures were not taken. We expended about $1,500—mostly for permanent work.

4. In 1904 we hope to complete the work of draining, filling and cleaning up the remaining wet places in town.

Our sewer system will be in use during the year, and the work of filling up over 1,500 cesspools will begin. These cesspools have been generally oiled, but many have escaped attention. They are great breeders of domestic mosquitoes unless covered with oil.

Our village trustees are now awake to the importance of caring for our water-ways, and water from streets will not be allowed to pour into vacant lots to form breeding places.

The township authorities are keeping the East Branch of the Rahway River cleaned out to its proper depth. They should also keep all street gutters clean and free from standing water. Many property owners have done a great deal of draining on their own account and much more is promised.

5. If we have about $2,000 to spend and an average summer rain fall, we confidently predict a smaller supply of mosquitoes in South Orange than ever before.

6. We have every reason to expect West Orange, Orange and East

Orange to join in the movement in 1904. Vailsburg and Maplewood may also do something. Newark and Elizabeth have already begun drainage work on the salt marshes.

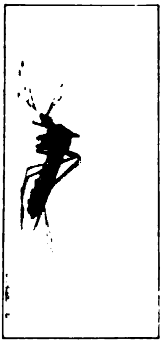
We desire a subscription from every householder in the village, however small it may be. This work is for the benefit of all, and all should support the movement.

The improved appearance of our village, resulting from our work, should entitle the committee to receive the support of the whole community.

Forward subscriptions to

MR. E. S. ALLEN, *Treasurer,*
Scotland Road, South Orange, N. J.

PHOTOGRAPHS FROM LIFE OF TWO KINDS OF DOMESTIC MOSQUITOES.



(About 3 Times Life Size.)

THE COMMON HOUSE MOSQUITO.

(Culex pipiens.)

Showing characteristic resting position on side wall. Wrigglers seen in rain barrels produce these.

These mosquitoes may be found hibernating in cellars in winter and may be breeding there if water is allowed to remain standing.

BY WM. L. UNDERWOOD.
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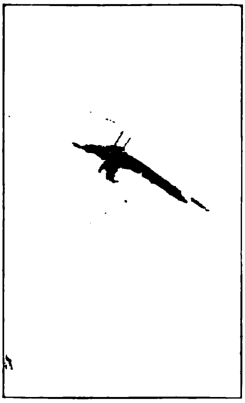

THE DANGEROUS MALARIAL MOSQUITO.

(Anopheles punctipennis.)

Note that this mosquito rests with body at an angle to the side wall—body and beak in a straight line.

If such be found anywhere in the village, report the fact at once to the Board of Health or to the committee.

copyrighted,
BY WM. L. UNDERWOOD.

THE DRAINAGE COMMITTEE OF THE
VILLAGE IMPROVEMENT SOCIETY OF SOUTH ORANGE,
SPENCER MILLER, *Chairman.*
E. S. ALLEN, *Secretary and Treas.*
E. V. CONNETT.
R. S. SINCLAIR.

The work is being continued on the same lines and several other municipalities are following their example.

In my own City of Newark the problem is much larger and more complicated in that we have had to deal with an area of some three thousand five hundred acres of salt marsh. These marshes breed in countless million the Sollicitans, a migratory species, and consequently furnish a large supply not only to our own city but to the adjoining towns. To still further complicate the situation there are in the vicinity forty thousand more acres over which we have no control, and hence concerted action by all the municipalities bordering thereon, not only in New Jersey, but also in New York becomes a necessity if satisfactory and permanent relief is to be obtained.

Newark has taken the lead through its board of health and by the expenditure of $5,000 especially appropriated by the common council for this purpose, has rid its entire meadow area of breeding places with the exception of about forty acres of particularly low-lying ground where it will be necessary to construct tide gates to lower the water level. Even this tract has been comparatively free during the season just passed.

The method employed was draining the meadows by means of narrow ditches about six inches wide and from two to two and one-half feet in depth dug at intervals of from sixty to one hundred feet apart. It is not to be understood that the entire area of three thousand five hundred acres was thus ditched, as on a large portion of this tract it was found unnecessary to do anything, but whenever breeding places were found this method was pursued and with marked success. In all some three hundred and sixty thousand lineal feet of ditches were dug. Assuming the entire appropriation to have been used in this work, the cost would be less than one and a half cents per lineal foot of ditch. Part of the work was done by hand and part by a machine known as the "True Ditcher." Where long ditches are required the machine work is cheaper, but for short ditches hand work was found more economical. As high as four thousand feet were cut in a single day with the machine. The ditches cut last season were found to be in good condition in the spring, and it has only required the services of one man during the present season to cover the entire area and keep everything in working order.

As has been stated above, while the results of this work have been most satisfactory, not a mosquito having been bred on the treated area during the present summer, we require the help of our neighbors in carrying on the good work. The City of Elizabeth, adjoining us on the south, has spent $1,000 in draining the salt marshes within its territory, and during the present summer has taken advantage of the state aid mentioned above, appropriated $2,000 more and received $500 from the state treasury. The appropriation by the City of New York for the Staten Island meadows above mentioned will also materially help us. Hundreds of scores of marsh land at Kearney are being filled by means of hydraulic dreges by private enterprise. Enormous increases in land valuation have followed the draining of about two thousand acres of lowlands along the Shrewsbury river, thus proving the economic as well as the sanitary value of the work. Many other cities and towns throughout the state have taken up the question either officially or through local improvement societies.

I will not trespass longer on your time by detailing other work already completed or now going on in our state. Enough has been said to show the widespread interest that has been awakened. The mosquito is still with us but enough has been done to lead us to hope that the movement will continue until at least a material relief from present conditions is obtained.

I cannot better close than with a quotation from the introduction of Dr. Howard's work. If these words were true in 1901, how much more so in the light of what has since been accomplished: "With the knowledge which we now possess it seems almost incredible that people should all these years have suffered, more or less patiently, the tormenting bites of Culex and the insidious but more dangerous punctures of Anopheles without making the slightest effort to abate the nuisance and the danger."

THE PRESIDENT: The report of the committee is now open for discussion.

MR. HOWARD: I want first of all to fecilitate Mr. Rankine on his very able exposition of this most interesting subject. I have given the subject some attention, and have followed with care the manner in which New Orleans is dealing with the mosquito problem. I agree with Mr. Rankine when he says that the mosquito problem is one of the greatest in the country.

Now, I would like to ask a question and that is, what is the essential principle that retains the mosquitoes on the Newark meadows. Is it the circulation of free water, or the stagnation of ponds and things of that kind?

MR. RANKINE: There are two principles involved in this, and the way to get rid of them would be either to dig ditches and drain out those stagnant ponds, and also to drain all the standing water which accumulates during a rain; or to open out those ditches and allow the small fish to get into them. When there are small fish there are no mosquitoes.

MR. RUST: Do I understand Mr. Rankine to say that where there are small fish there are no mosquitoes? I may say at once that that is not our experience.

THE PRESIDENT: I think that Mr. Rankin meant that the mosquitoes will not become mosquitoes at that particular spot where the small fish are. That is to say that the fish will eat them before they have developed into mosquitoes.

Mr. Rust: We have lots of fish and lots of mosquitoes.

The President: They may originate in pools where there are no fish.

Mr. Rust: There are not any pools for them to originate in.

Mr. Rankine: The only way that I know that could happen would be that they would either originate in pools, or tanks, or barrels, or something of the kind where the fish could not get. There the larvae would develop.

Mr. Reimer: I live right alondside of Mr. Rankin, so far as municipalities go, and a southeast wind sends the mosquitoes right up to us.

Mr. Rankine: They come from Staten Island.

Mr. Reimer: I have no doubt they do. But there is something in the general view of mosquitoes that I have never been able to satisfy myself upon, and that is this, in the ordinary dry season they are very few, but if you have a rain for a little while you will see them in swarms. It seems as though every bush had been stocked with them, and that they were only waiting for the rain to bring them out. Is there any one who can give us any information as to what connection the rain has with them?

Before the rain everything is lovely, and there are not many mosquitoes, and they do not bother you to any extent, but two or three hours after the rain you come out of the house and they are so thick that you do not know where to go to get away from them. This condition of affairs lasts for two or three days and then they disappear again, and things are the same as they were before. This happens every time we have a shower of rain.

Mr. Eggers: I have been a citizen of Newark since 1858, and I have had considerable experience with mosquitoes. For the last twenty-four years I have lived at about the highest point in the City of Newark, and we were constantly bothered with mosquitoes.

Within the last two years I am glad to say that we have noticed that they are not so numerous.

This last season I have been able to sit in the piazza with my family almost every evening without being bothered by the mosquitoes. To tell the truth I do not think that there were more than two or three nights that we were troubled with them anything worth speaking of.

Another thing I might tell you is this. I have some blackberry bushes around my yard, and it was always a great trouble to go out and pick the berries, on account of the mosquitoes. This year, during the time that the blackberries were ripe we did not have that trouble at all. I was in the habit of going out myself and picking some of them, and I was not bothered with the mosquitoes.

I think you will agree with me that this is a sign that the mosquitoes are diminishing around Newark.

I understand that they have a lot of mosquitoes in the Oranges yet. I know that I have been through that part of the country several times, and I saw them building right along the edge of the meadows. That would not have been allowed in Newark. I tell you they are breeding mosquitoes very fast there.

MR. GROSSER: I am exceedingly glad that Mr. Eggers has spoken. What he has said has been information to me. He told us that for the past two years he has noticed that there are fewer mosquitoes than formerly. Now, I have been wondering where our mosquitoes come from (because we have about as many as we want, and a few to spare) and it was not till Mr. Eggers said that they have left him that I realize that they have all come across the lake to us.

A few years ago we in Chicago used to be able to sit on our verandas but we have not been able to do that lately. I am afraid that they got tired of New Jersey and are striking out West. In order to get rid of them in Chicago we use the old remedy—a slap.

MR. HAZLEHURST: Mr. Chairman, this paper has a peculiar interest for me. The gentlemen who have preceded me have all spoken along the line of the nuisance that the mosquito is. They have spoken of the Culex and the other varieties of mosquito, but none of them have mentioned the worst of them all, the stygomia—the deadly yellow fever mosquito. We have this pest, and have had to deal with it.

The country has been particularly impressed with the lessons which have been taught in Cuba, and the experiments which have been made by the United States government, and we are working on those lines in my section. Today my town of Mobile, Alabama, is surrounded by yellow fever on all sides—Pensacola, Natchez, Vicksburg, New Orleans—all have the yellow fever.

Shortly after the outbreak in New Orleans there was a mass meeting called in Mobile, which was very largely attended, and they determined there to watch the mosquito, believing firmly in the theory that the stygomia family were the originators and propagators of the fever.

The organization that was formed that night undertook to finance a battle against the mosquito, and determined to raise the amount that was required, which was about fifteen thousand dollars. There was also a committee on education and an executive committee appointed. The citizens did me the honor of appointing me as superintendent of the Executive Committee.

It might be interesting to you gentlemen to know what fight we had made up to the time I left to attend this convention, and what success we have had.

Our city comprises about a hundred miles of streets. Its topography is very flat and low. The main difficulty with us is a want of drainage. We have only a few sewers in the town, and a great many of our outlying districts have only surface ditches, and these being cleaned out from time to time the loose loam soil has been thrown up aside, and in many cases the lots are higher than the street. So, after our heavy tropical rains whole sections are sometimes inundated, and a great many houses of the poorer classes, particularly, and in the negro quarters are surrounded by ponds of water which generally lie there till they evaporate.

The organization that was formed at that meeting has divided the city into eight districts, and a detail of police were appointed by the mayor, to be under my supervision. This detail consisted of eight men, one for each section. Each of these men had an assistant, and it was their duty to make a house to house canvass and inspection, and report on the sanitary condition of the premises in general. and to mention specially anything in the way of water leaking from cisterns, or unsanitary plumbing in the houses. They also reported whether the lot had any water standing on it, and the amount of weeds that covered the ground, and whether they had grown to any height, as they do down there in a very short time.

Those men had instructions to correct any minor details that they came across, without reporting them. By minor details I mean such things as turning over cans that had stagnant water in them or turning over barrels, tubs or such things. The officer also had with them circulars we had printed for the purpose and he had to distribute them.

Knowing that this matter of the mosquito was coming up I brought one of those circulars with me. It is as follows:

"You are expected to help in the work..

Q. What work?

A. Destruction of mosquitoes.

Q. What is that for?

A. To protect every citizen and every occupant of Mobile, his life and health, business or employment, not to speak of the future prosperity of the city.

Q. How is that connected with mosquitoes?

A. Well, it is just this way: Yellow fever has a start in New Orleans. The authorities are doing everything in their power to keep any one from coming in here who may have a yellow fever in his blood. But, if notwithstanding the good quarantine system, such a person should come in here, yellow fever could not spread except for the domestic mosquito. This mosquito has to suck up the blood of a yellow fever patient, which blood contains the germ of yellow fever. After twelve days these germs have grown in the mosquito's poison sac, so that when it bites anyone it passes the yellow fever germ into the person's blood. So you see we must get to work and prevent this.

Q. How are we going to do it?

A. Well, let's all help make quarantine effective, and not leave all the detective work to the authorities, so we can send quarantine violators to a safe place at once. Let's cover all fever cases with mosquito bars till the doctor tells us what the disease is.

Let's kill the mosquitoes where they hatch; kill others wherever we can. In short, here are the

RULES FOR EXTERMINATION.

(Keep those rules where you can see them.)

1. Put fine netting over cisterns, wells and tanks of water required for every day use, and put layer of kerosene on surface of the water.

2. Dump all standing water that has collected on the premises in accidental receptacles, such as vases, barrels, tubs, stopped up roof gutters, etc.

3. Change often the water needed in barns, chicken coops, kennels, etc.

4. Drain or fill in all pools or hollows on premises likely to collect rain water.

5. If wrigglers are found to exist in water required for every day use, as in barrels, cisterns, etc., cover with a thin layer of petroleum or kerosene, half a tea cup to every fifteen feet of surface. If the odor of these oils is objectionable, oil of eucalyptus may be substituted where expense is immaterial. Note increase of malarial and other fevers two or three weeks after a rainy spell: mosquitoes are the cause.

6. Kill grown mosquitoes in dwellings by fumigating with sulphur, formaldehyde or pyrethrum (Persian insect powder). The Pyrethrum (insect powder) should be moistened into thick paste and dried in or under the stove. It will then burn and smoke without difficulty. The mosquitoes will be stupified and fall to the floor, when they may be easily swept up and destroyed. Burning pyrethrum powder out of doors will keep mosquitoes away from the immediate vicinity.

7. Remember you owe it to your neighbors as well as to yourself and family to prevent the breeding of mosquitoes on your premises. Examine your lot and house carefully at least once a week. If you find wrigglers in any water on the place you are raising a crop of mosquitoes that will be a source of annoyance and danger to the neighborhood.

THE AUXILIARY SANITARY ASSOCIATION OF MOBILE."

As you notice this pamphlet was written in a conversational style, just to give the people an idea of what they ought to do. It was distributed by the thousand, and the officer was directed to notify each tenant, or each inhabitant of the danger of having standing water on his premises, or leaks in the sewer service, or leaks in the water service, or high weeds. As soon as any reports were received they were turned over to the police chief, the superintendent of water works, or the superintendent of sanitary plumbing, and there were specific orders from the mayor that they should begin immediately to correct those defects.

Those eight men, for the sections had five laborers with them, and one cart, and they were supplied with oil and lime, and they were given general directions to go to the houses that had been reported by the officers, and to correct the trouble that had been reported.

In many instances it became necessary to drain the ditches to get rid of the water under the house.

We adopted a pretty large and broad plan in cutting the weeds. We started three two-horse mowing machines and they worked in the lots where the weeds were growing high, and where the tenants were poor and could not cut the weeds themselves. We thought it better to do the work ourselves than waste the time trying to force them to do it.

We cut from eighty to one hundred acres of weeds with those three machines and five men with scythes, for use where the machines could not go, and so on.

While it is true that probably the weeds have not any effect upon the mosquito, still we look upon them as a collateral. We found that the tall, rank weeds were a roosting place, if I may use the expression for the mosquitoes, and when the scythes went through them you could see the mosquitoes coming out in flocks. We also found that when we cut the weeds it would give the wind an opportunity to get at the pools and they would be evaporated much sooner, and we got rid of a good many standing pools in that way.

Besides the eight gangs whose duty it was to clean up the premises we put a gang out oiling, which consisted of a foreman, two laborers and a cart. They carried the oil in the cart, and the laborers were supplied with a force pump and one of those sprinkling machines. This held about three or four gallons. This gang would go to the open pools and ditches (and around Mobile we have a large number of old batteries; they were there forty years ago, but have not been used for years, and have never been filled up) and they would spread the oil on the water that they found in those places.

The oil we used was crude petroleum mixed with kerosene. We found that the Beaumont oil was a little too heavy to spray properly, but when it was mixed with kerosene we found that it sprayed very well, and made a good surface over the water. We also used a by-product of wood tar, which is called "pyro-creosol" and found it to be a good germicide when placed in the water. It spread out and made a sort of a milky colored mess.

We also used a good many barrels of permanganate of potassium. That was granted to some of the local physicians. Probably you all know that permanagnate of potassium is the basis of Condy's disinfecting fluid, and is of course a very good germicide.

I believe that is about the extent of our experience. We are still keeping up the fight, which has been successful so far, although we are peculiarly situated in Mobile. We have a large export trade with many southern ports—we have steamers coming from the Bocas del toro, and Port Lemon, and have as many opportunities of bringing the fever to us as perhaps any other place in the district.

THE PRESIDENT: Are there any other remarks on this question?

MR. POLLOCK: I would like to ask Mr. Rankine if he thinks the mosquito can fly any distance? Some of the mosquito experts seem to claim that it can fly over a mile.

MR. RANKINE: That depends on the mosquito, as I stated in my paper. Some species do not fly over two or three hundred feet, while others have been known to fly as far as fifty miles. That has been actually proved. The salt marsh mosquito is one of those that can fly a long distance.

MR. POLLOCK: Some people claim that they will not breed in the salt marshes.

MR. RANKINE: They do. Some of them will not breed any place else, and those salt marsh mosquitoes have been identified clearly, and are thoroughly known, and, to show you that they can fly, some of them have been found miles from a salt marsh.

MR. CRANDALL: I did not hear all Mr. Hazlehurst's address, but would like to know if any record has been kept of the cost of this campaign. I do not know if the matter was discussed, and if it has not I think it would be interesting to know what it cost.

MR. HAZLEHURST: In answer to Mr. Crandall's question, I would say that at the time I left our pay rolls were running about a thousand dollars a week, and our supplies were costing about three hundred and fifty dollars a week.

The crude oil that we use costs us six cents a gallon, the kerosene costs us eight cents a gallon. The permanganate of potassium was pretty steep. Two barrels of it cost $177.50.

I might say that Dr. Howard, the United States entomologist, says in his work on the mosquito that permanganate of potassium is of very little service, but still we rather listened to the pretensions of some of our doctors. They thought that it was a good thing, but I am not sure that it was of any real benefit, although it helped to run up our expense account pretty high.

Mr. Kendrick (Toronto): With reference to permanganate of potassium I may say this: Several years ago we were troubled with mosquitoes at the back part of our house, where there were trees, and where it was damp and shady all the time. My brother read somewhere that permanganate of potassium was a good thing for such a condition, and he bought a few pounds of it, which he dissolved in water and sprayed around. We had no mosquitoes that year, and we have had none since, for the spraying has been repeated once or twice since then. From this experience I am inclined to think that there is something in the doctor's prescription.

The President: This discussion has certainly brought out the fact that the celebrated Eastern state has not a mortgage on the mosquito. It is my opinion that you will find mosquitoes everywhere, whether you go east or west. The worst crowd of them that I ever ran across in my life was up along the shore in Connecticut. I was rather inclined to be afraid of them there.

We will now hear a paper on "A Standard for Disinfectants," by Mr. William S. Crandall.

Mr. Crandall's paper was as follows:

A STANDARD FOR DISINFECTANTS.

BY WILLIAM S. CRANDALL, NEW YORK CITY.

It is four short years ago that mankind was busy rehearsing the miraculous achievements of the wonderful century that had just closed. Perhaps the greatest and most beneficial progress which has been made during the later past, was made along the lines of medical science, and that one of the most important of these lines has been that of sanitation.

The French philosopher, Boileau, declared, in speaking of honors heaped upon Napoleon, that men seem ever ready to give greater glory to their destroyers than to their benefactors. But today the benefactors of the race are having their turn, and the "medicine man" is regaining something of his old-time prestige. The applause of the multitude for the brilliant genius of Oyama and Togo and for the heroic fortitude of Stoeffel and Rojestvensky is equaled in sincerity by the generous appreciation of the sanitary measures enforced on the one side and the criticism of the unsanitary measures on the other side of the tremendous conflict in the far East.

The Japanese medical corps precede their army with dinisfectants instead of following with remedies, and fight bacilli with a strategy and a pugnacity equal to that with which the main army opposes the shells of the enemy. And when the final record of the war is written the doctors should be credited with a large measure of the glory of the victory, and the man behind the leather case should have equal honor with the man behind the gun. One of the greatest results of the Russo-Japanese war will be the rapid and scientific development of sanitation and the use of disinfectants throughout all countries.

At the very beginning of this increased use of disinfectants we are met by the fact that while a measureable proportion of human happiness depends upon their proper use, there is a great danger in their misuse. That disinfectants sufficiently potent to be advantageous are frequently dangerous tools in untrained hands, and hence, call for the enactment of stringent local laws, amounting to the practical prohibition of their sale except on evidence of a proper knowledge of their use.

It is a serious problem to solve, admitting the danger in the popular use of virulent poisons, and recognizing the opposing danger in their non-use, as to where to draw the line wisely. One case of infectious disease improperly cared for may become epidemic and involve a community.

The solution of the question requires a consideration for the public health balanced against accidents incident to public ignorance. The health of the masses is undoubtedly pre-eminent, and individual misuse, however deplorable its result may be at times, must be provided against by individual care. The ordinary friction match and the use of gas and kerosene oil are each almost, if not more destructive to property and life than the accidental poisoning from disinfectants.

The word "poison" is, however, a red flag of danger, and contains an element of indefinable dread. The man who just misses being smashed on the railroad, or drowned in trying to catch the ferry boat, does not give the incident a second thought, but tell him that common salt is poison and wherewithal will he ever again be salted.

The natural result is that in an effort to meet the demand for disinfectants, and yet comply with the law, the manufacturers place on the market harmless germicides which are usually as free of danger to bacterial life as they are to human life. Such preparations do possess one danger, however, in that they induce a sense of false security in the purchaser.

In this connection the difference between the disinfectants and deodorizers should be mentioned, for too often the public is misled to believe that the work of a true disinfectant is being performed by a deodorizer, when the truth may be that the latter is perfectly useless except as a destroyer of disagreeable odors. It is important to use and recommend for the purpose of sanitary disinfection exclusively those products which not only have the properties necessary to a deodorizer but also the more valuable and vital properties required of a disinfectant worthy the name.

Among the familiar sayings of the peoples of earth there are always to be found many in praise of truth, and whether we say: "A spade should be called a spade," or "Honesty is the best policy," or what not, a pharmaceutical preparation should invariably bear upon its face its name and its nature.

Every germicidal preparation should have an authorative value placed upon it by the government. The government is more and more regulating manufactured goods and has already prescribed some formulas in the drug line. But, at present, neither the federal nor the state governments make any provision for the standardization of disinfectants, and, there is, therefore, no accepted measuring stick by which the value of a germicide may be officially determined. The health officials of several states favor such action, but those of perhaps a majority of the states are indifferent to the subject. Though America is not behind other countries in action in this matter, we are far behind in the agitation that will generate such action. and we should bestir ourselves at once to establish some formula whereby the value of disinfectants which are sold in the market may be stated in known terms.

The argument in favor of this step may be briefly stated: That the state would under such conditions assume the practical control of the manufacture of each preparation placed on sale of an article of vital importance to the public health, and the efficiency of the article would be positively determined and the public protected against fraud.

What this standard should be must be determined by the chemists. Pure phenol has been recommended as the most practical for comparison by the eminent scientists who prepared the report to the Sanitary Institute Congress held in England in 1903, and bacteriological as well as chemical tests are proposed to determine the efficiency of the disinfectant.

This report suggests the following points to be considered in making the comparative tests: 1, time; 2, age of culture; 3, choice of medium—reaction of the same; 4, temperature of incubation; 5, temperature of medication; 6, variations in vital resistance of same species; 7, variations in vital resistance of different species; 8, proportion of culture to disinfectant.

It is admitted that this is a rather formidable series of comparisons, but it is stated in explanation that with pure phenol as the standard—the pure crystals of which contain from seven to eight per cent. of water—and, if standardizing a solution by means of bromide be regarded as too tedious a process, the bromo-phenol article will be found to answer the purpose admirably, as 110 parts by weight of bromo-phenol carbolic acid contains 100 parts by weight of pure phenol. This disinfectant, too, has other marked advantages over any metallic salt or other standard, and no other standard could be chosen with which comparison could be made so readily and so satisfactorily.

The British Sanitary Institute has declared in this connection that there is no control in England over the sale of disinfectants except the permits relating to the sale of poisons. "The first of these permits the sale, without control, of liquids containing less than three per cent. of carbolic acid or its homologues as disinfectants on the ground that such fluid is not a poison within the meaning of the pharmacy act, and this has the direct effect obviously of placing a premium on inefficiency. * * * A bacterial rather than a chemical determination of efficiency is required, as, although the strength of a preparation of carbolic acid and its homologues can be ascertained with great accuracy, it is a well known fact that cyllin, for example, does not depend for its remarkable efficiency as a bactericide on the content of that acid. Again, much depends upon the conditions, both chemical and physical, in which the disinfectant is employed. * * * There is, therefore, a great need for a bacteriological test."

There seems to be a necessity, therefore, for some standard that must gauge the chemical and bacterial efficiency of disinfectants. The demand for such precaution has increased in rapid ratio year by year and will be constantly more imperative with the development of sanitary science and with the impulse given the subject by the revelation to the world of the possibilities along this line in the methods and practices of the Japanese medical corps.

The question of how best to attain the desired end is perhaps open to discussion on the point whether it should be left to the health boards of the several states or should be undertaken by the national government. The latter course is probably the better way. Between the states there is so much divergence in legislation even on identical questions, that if left to them there would likely be some forty-odd differing standards. The establishing of standards is an attribute of government, and, to avoid a heterogeneous list of tests the general government should exercise its function. The influence alone of the adoption of a standard by the army and navy departments would go far toward establishing a measure of effectiveness for germicides.

Should there be some regulation requiring all poisons to be put up in bottles of a special or peculiar shape, as is the case in some places in England, so that the sense of touch would warn of danger, it would be much safer to permit unrestricted use of really efficient disinfectants.

It is an oriental custom which employs the family doctor, by the year, to keep the family well, and stops his pay during cases of sickness. In our growing knowledge of sanitation we are adopting this "ounce of prevention" idea. The intelligent use of disinfectants is an essential element in this development, and we shall lack wisdom if we fail to appreciate it.

THE PRESIDENT: We have also a paper by Mr. J. M. Hazlehurst, of Mobile, Ala., on the subject of "Sanitary Engineering in the Southern States." I am pleased to call upon Mr. Hazlehurst to present his paper to the meeting.

Mr. Hazlehurst's paper was as follows:

SANITARY ENGINEERING IN THE SOUTHERN STATES.

BY J. N. HAZLEHURST.

Reminder of a civilization more remote than sacred or secular history; back into the very night of time; antedating that shadowy epoch of Sargon I, authenticated at 3750 years before the Christian era, and created possibly seven thousand years ago, now amid the crumbling and forgotten ruins of the dead City of Nippur has been found well preserved portions of an efficient drainage system.

Underneath the tiled pavements of the upper and more recent city, lie, properly jointed with bithulithic material, sections of burned clay pipe, constructed after the regulation bell-and-spiggot pattern, although of shorter length than the manufacture of today.

Beside these hoary relics and venerable ruins the ancient drainage of Jerusalem and that of the Cloaca Maxima, of Rome, are but creations of yesterday.

Yet despite these ghostly fragments of a long-forgotten past, it is but within a short fifty years that modern scientific effort has been directed toward the correct solution of problems effecting the sanitation of populous communities.

In the year 1880, a distinct and radical advance in the science of sanitary engineering was made when the late Col. George E. Waring advocated and demonstrated the advantage and efficiency of the separate system of sewers, predicted upon the divorcement of the domestic waste from stormwater run-off.

Financially unable to assume the enormous cost of constructing an adequate and comprehensive system of sewers of the combined type, yet smarting under the scourge of a most virulent epidemic of yellow fever, and determined to restore confidence and regain commercial prestige at whatever cost, the City of Memphis, Tennessee, pledged its credit to embark upon the then uncertain and hazardous engineering project of the construction of sewers intended to provide entirely for the disposal of sewage water carriage. Thus the South, amongst the first to ascribe to this new departure in sanitary engineering, succeeded in a practical demonstration of the soundness of these advanced theories, rested from her labors, and was for long content to point to Memphis alone as evidence of such progress.

With the phenomenal agricultural, commercial and industrial prosperity of the Southern States since the year 1890, came the pressing demand for the improved and scientific sanitation of her cities, and many of these, commencing about that time, undertook the extension of existing and fragmentary systems of combined and separate sewers, or arranged for the construction of new works, amongst these being Richmond, Norfolk, Chattanooga, Nashville, Atlanta, Macon, Charleston, Jacksonville, Brunswick, Montgomery, Birmingham, and Houston; numerous of the smaller towns sooner or later following the good example of the more populous communities.

Of the larger municipalities of the South, Galveston and New Orleans alone remain unsewered, a condition which the latter city is at the present time actively and rapidly undertaking to remedy.

As compared with the progress and development of a majority of the other cities of the Union, those of the Southern section have been admittedly backward in this as well as in many other municipal improvements, and it is only fair to that section to recall to the hypercritical the fact that only within a comparatively short period have the cities below the Mason and Dixon line had the financial credit to undertake extensive public works, since following the desolation wrought by civil war, the more recent so-called reconstruction period with its baneful and unscrupulous legislation, dissipated revenues and pledged posterity unborn to the repayment of vast indebtedness from which no return was ever to be realized by these municipalities.

But with the passing of the shadow of those unhappy days, a more prosperous era has dawned and a new generation, fully alive to the demands of scientific attainment, determines to measure up to the highest standards of American civilization.

More than all others, perhaps, those of our profession insist upon results, and are impatient of excuses, hence with this brief defense of a situation for which the South is not directly responsible, we will proceed.

The Southern States, with increasing and diversified industries and development along all commercial lines, is still largely an agricultural country, comparatively sparcely populated and with its communities and centers somewhat widely scattered; therefore the necessity for sewage purification works has not to the present time been pressing, nor considered a necessary adjunct to sewerage systems. Purification plants, however, have been constructed and are in operation at Houston, Texas; Danville, Ky., and at Charlotte, N. C., the first being designed upon the broad-irrigation principle, while the two last follow the septic method, but neither of them are of especial interest requiring extended mention. The same may be said of the great majority of the sewer systems so far constructed in the South, none having been designed with notable departure from the current practice, except the works now being installed at New Orleans, and concerning which a brief outline may be of interest.

Situated at the mouth or delta of the Mississippi River and upon the shores of Lake Ponchartrain, topographical conditions about the city are such that a levee system is necessary for protection against the high waters, hence a gravity system of sewers becomes an impossibility.

In the general design of the New Orleans sanitary system, the engineer, Mr. George G. Earl, M. Am. Soc. C. E., has provided for the disposal of the sewage from collecting basins through the operation of three main and thirteen subsidiary pumping stations or lifts. The largest of these plants is designed to dispose of an ultimate flow of some eighty-two million gallon of sewage per 24 hours, discharging through a cast iron force main of 48-inch diameter into the river.

Following the usual practice, the unit of the system is the 8-inch vitrified sewer pipe, these laterals constituting 87 per cent. of the entire mileage. All pipe up to and including 36-inch are of vitrified clay, the larger mains up to the outfall of 6-foot diameter being constructed of brick or concrete, alternate proposals being received for the two materials upon each section of contract work let.

The general design of these sewers contemplates the ultimate construction of 900 miles of sewers of all sizes, while it is proposed to build at once some 400 miles, including the heavier sections. During the past two years more than 90 miles of sewers have been completed, about fifty miles of new work being advertised and let annually. At New Orleans, the Mississippi river passes with considerable current and immense volume even at the lowest stages of dry weather flow, and little apprehension of objectionable and delecterious pollution is entertained since calculations providing for a great increase in population, with allowance of 4 cubic feet of sewage per second per 1000 population, and to the extent of a daily discharge of 150 million gallons of sewage would show for solid matter, some one part in 86,000 by volume, and there passes during each minute of the day a volume of water equal to twice the amount of sewage proposed to be ultimately discharged in twenty-four hours.

The construction of these works offer many physical difficulties, owing to unstable soil conditions and its complete saturation at all points beneath the surface; an annual rainfall of more than 60 inches, generally confined to the summer months; the necessity for handling all seep water by pumping, and the almost certainty of encountering at any locality immense stumps of a virgin and extensive cypress forest long since buried from two to eight feet below the present surface of the ground. These natural obstacles and complicated with a most unsatisfactory labor situation have naturally been productive of high prices, the average for 8-inch pipe, with a depth of 6 to 8 feet, being about 90 cents per lineal foot of pipe furnished and laid.

In New Orleans, as in all of the Southern coastal cities, especial provision must be made to secure stable foundations and effective pipe-jointing, the latter being of primary importance to prevent overcharging the sewers through the infiltration of ground water and as well to provide against the influx of water-borne sand. Notwithstanding these precautions, liberal provision is always made for the entry of ground water, the allowance for that at New Orleans being assumed at some 26,000 gallons per mile of sewer, equivalent to a run-off of 0.003 cubic feet per second per acre.

Eighty gallons per day is the calculated per capita provision for household waste and 20 gallons for infiltration, the design of these sewers therefore being to provide for 100 gallons of sewage and ground water per capita of assumed population.

For the reasons given, the engineer responsible for secure foundations and a limited quantity of ground water must exercise especial care, both in actual construction and in the preparation of specifications governing such work. The following is an excerpt from a set of specifications drawn by the writer for sewer construction under such conditions:

"In soft ground, or where in the opinion of the engineer the soil is of such nature as to endanger the alignment of the sewer, lumber or other materials shall be placed as directed to secure a suitable foundation. Where quicksand is encountered, special foundations may be ordered by the engineer, but in general the construction at such spots shall consist of sound 2x12 inch planks, laid longitudinally, either with or without cross-stringers or sills, as may be ordered.

Along the foundation so prepared, the pipes shall be laid, wooden wedges being inserted under their barrels in such manner as to raise the bells clear of the foundations.

After jointing in the usual manner, a bandage or wrap of cheese cloth or similar approved material shall be tied about the connection in such manner as to fully protect the cement joint until after its initial set. The cost of such work shall be estimated at the price bid for the 'lumber in place.'"

With every public, as well as private enterprise of the South of today, the labor question has become almost significant, almost a dominant factor, and in view of its increasing importance its brief discussion here may not be out of place.

Of something more than eight million American negroes or persons of African descent, 90 per cent. reside in the Southern states and form almost entirely its laboring class, and seldom upon public works or elsewhere is the white man a competitor for strictly manual labor.

Without offering in comparison the economic value of the negro as a laborer in the past, all qualified observers agree that the colored individual of the present generation has deteriorated physically, and as a laborer is non-dependable and inefficient. Meanwhile the industrial expansion of the South has produced a labor demand which is neither being supplied by natural increase of the native population nor augmented by newly arriving aliens; hence in the South at the present time the labor situation is acute and is of such importance in connection with public improvements as to fairly merit this digression from the subject matter of this paper.

As evidence of irregularity and the non-dependability asserted, from the carefully analyzed statement of constructive operations over which the writer has had jurisdiction during a period of twelve months just passed, and where more than $10,000 has been paid in wages alone, exclusive of holidays or when work was impossible on account of weather conditions, the average of the actual time employed as contrasted with a possible opportunity for work amounted to 59.6 per cent., or simply stated the negro laborer was willing to work at exceptional wages and preferred employment only a little more than one-half of his time for the twelve months. For the purposes of comparison with white labor, the writer secured information along these lines from a division engineer of the New York Rapid Transit Commission, who writes: "I find that taking fifty Italian laborers they made 17,608 hours out of a possible 20,000 hours, making 88 per cent full time."

On railroad work, which for many reasons offers peculiar attractions to the negro laborer, the same story of lack of continuity and indolence is reported as may be inferred from the following quotation from a late letter from one of the superintendents of the Southern railway:

"During the month we were obliged to employ 706 men to do the work which under other circumstances 340 men could have performed; in other words, the men instead of averaging twenty-six days per month, actually averaged about twelve days each."

Under the stress of circumstances the competition for labor in the South has led to a steady increase in wages, many cities paying from $1.50 to $2.00 for unskilled labor; $1.80 being the average for negro sewer men on contracts aggregating more than $200,000 in New Orleans and with which the writer was indirectly connected during the past year.

With white employees, an increase of wages is generally followed by a marked additional effort, but an advance in the negro's wage scale produces just the opposite effect, since he works only sufficient for actual maintenance, and augmented wages is followed by a direct and corresponding reduction of effort.

The improvidence and shiftlessness of the average negro in the South may be best illustrated from some such record as that shown by the Sexton's annual reports, which compiled for the past seven years shows that of the entire number of negro deaths in Mobile County, Alabama, for the average fiscal period, more than one-half have been buried as paupers at the public expense, and the extent of this economic loss may be understood when the fact is stated that about one-half the entire population of the county quoted, or something like 20,000 are persons of negro descent.

The recitation of these facts in connection with the labor situation at the South is but the concrete expression of distressing economic conditions only too familiar to all employers in that section of the country. From long and familiar associations with the colored individual and masses, the Southern white man has been willing to overlook the many weaknesses and failings of the negro laborer, but in the progress of the nation no longer can be postponed the realization of the industrial and economic incubus represented by the negro race at the present time, and there has arisen an imperative demand for more dependable labor in every vocation and in all fields of human endeavor.

In the South the natural increase is deficient both in numbers and quality, and it is now recognized generally that the only hope for a satisfactory solution of the labor problem is through desirable immigration; its judicious selection, and proper distribution.

The questions of labor and immigration are of vital interest to any engineering or industrial proposition in the South, and the proper direction of immigration is one which must appeal to all sections of the United States; to all classes of its people but with particular force to those whose effort it is to secure a satisfactory labor for municipal improvements of the first magnitude, the writer will not further excuse himself for again digressing, and touching upon this somewhat alien subject. Under the haphazard policy of the United States permitting indiscriminate immigration of all nationalities except the Chinese, and relying upon a small class prescription as applied to individuals, with an absence of all effort to regulate or direct the influx of aliens, undesirable admissions and unnecessary congestion is a certain assumption.

As evidence of the inconsistency in the matter of distribution, from the reports of the Commissioner General of Immigration for the fiscal year, the ultimate destination of something more than four hundred thousand foreigners is given as being the two states of New York and Pennsylvania, while of nearly a million immigrants, North Carolina received 112, while South Carolina's quota was 95 new arrivals.

Conclusions are obvious although space permits no further amplification, but before concluding, incidentally it is suggested that the states of the Union should make careful study of the immigration laws of this great Dominion of Canada and learn a lesson from her proceedure and legislation governing immigration.

Her statutes are equitable, effective and admirable and while providing for the judicious selection and distribution of those who would cast their lot and identify their interests with this great commonwealth, offer every reasonable protection to the vested interest of her present citizenship while providing for the commercial, industrial and agricultural demands of her rapidly developing provinces.

This brief reference to Canada's immigration laws has not been made for the purpose of paying a deserved tribute to our hosts of today, but is incidental to the imperative necessity for a revision of our own immigration regulations to accord with great and pressing economic demands within our own boundaries and which must appeal to thoughtful individuals everywhere, but which should be of especial interest and enlist the active effort of such of us whose life-work in the direction of nature's forces to provide for the wants of man calls for the co-operation of brawn and muscle as well as the highly developed mental effort of human endeavor.

MR. HAZLEHURST: I wish to add that this paper does not cover the ground as I would like to have done, if I had the time at my disposal. I suppose I may blame myself, for I had sufficient notice to prepare the paper, but in excuse I might plead that the yellow fever and mosquitoes were bothering me some, and I postponed the preparation of my paper, until finally I had to rush it through and was not able to secure all the data I wanted for the proper presentation of the subject. I offer this as an apology for the rambling way in which the paper reads.

THE PRESIDENT: I think the simplest way of answering Mr. Hazlehurst is to say that his excellent paper is now open for discussion.

THE SECRETARY: I was interested in Hr. Hazlehurst's reference to the work that has been done in Memphis, Tenn., inasmuch as some of the first engineering work that I ever did was in that city, in 1880, when Colonel Waring made his arrangements for constructing the sewerage system. I went there together with an engineering force from all parts of the country, and there was a surprising amount of work done there from the first of February till the first of June, 1880.

The system was what was then called, and is now, a separate system, and all the laterals were six inches instead of eight, as I understood Mr. Hazlehurst to say the system is now.

It has been found that the six inch pipes are too small, and it has been found necessary to construct manholes at different points along the line, which were left out entirely in the original plan.

We went there in February, 1880, directly after a yellow fever epidemic, which raged in 1878 and 1879, and there were a great many pools of water scattered all over the place, and we were sure that in each of those pools there were millions of yellow fever germs. Soon after we arrived we heard of two or three deaths that had occurred after the victim had been stung twenty-four or thirty-six hours previously. We were told that they were not cases of yellow fever, but we decided that it did not make any difference whether it was yellow fever or not; that what we had to do was to get that work done as quickly as possible, or a good many of us might never get out of the place.

The situation there at the time was such that the merest rumor as to a case of yellow fever was sufficient to scare us out of our boots, so to speak.

I remember one line of houses there, and in the rear of the lots three old cesspools were encountered within a distance of one hundred feet. They looked as if they had just been covered over and left there. You can imagine the result in such a climate as that. Such cases as that were not uncommon all over the city where we were working.

I think it is almost incredible that a city with 40,000 inhabitants, such as Memphis was at that time, should be able to get along without being wiped out entirely, owing to the climate and the lack of sewerage arrangements.

The result of the work at that time, as you all know, was very successful. They have had practically no yellow fever in Memphis since that time. The drainage water was kept out of the sewers as much as possible. The idea was to make a water-tight joint, and this was accomplished by pressing a gasket of oakum into the joint as far as it would go, and then filling the joint with neat cement. It was thoroughly satisfactory. Where there was much water tiles were laid alongside the main pipe so that as much of the subsurface water as possible would be carried off in that way.

Memphis was peculiarly laid out, because it had lanes running north and south and east and west, and the blocks divided up were equal to a city block, and they were divided up into four sections, so that when the sewers were constructed in all the streets and alleys (as they were in pretty nearly the whole city), the place was thoroughly covered with branches of the sewerage system, and it must have been quite effective, and those tile drains must have been effective in draining the subsoil. However, it is a clayey soil, so that they would not drain anything like as much area as in some of the Northern cities.

THE PRESIDENT: If there is no further discussion on this paper we will proceed to the next one, which is entitled "Sewage Disposal, an Experiment and an Experience," by Mr. W. H. V. Reimer, City Engineer, East Orange, N. J. If Mr. Reimer is prepared to read his paper, we would be glad to hear him.

MR. REIMER: In presenting this paper it is not the intention of the writer to go into the pros and cons of sewage disposal, or to in any way condemn the use of disposal plants. We all know that local sewage disposal is of vital interest to all of our inland towns, and that such disposal is the only method which, as a rule, may be used, but if, through the experience which East Orange has had, other communities may be able to avoid the difficulties which swamped our plant and made us a nuisance to our neighbors, our object will have been in some measure attained.

SEWAGE DISPOSAL—AN EXPERIMENT AND AN EXPERIENCE.

BY W. H. V. REIMER, EAST ORANGE, N. J.

In the year 1880 the Township of East Orange (now a city), New Jersey, had a population of 8,300 and an area of four square miles. Two small hat factories comprised its manufactures. Its proximity to the large manufacturing and commercial City of Newark placed all mercantile ventures in jeopardy, and from centre to centre of city and township, but two and three-quarters miles intervened, while convenient transit was furnished by horse cars and steam railroad. It was a purely residential community, many of its inhabitants using it chiefly as a sleeping place at night, while attending to their business through the day in New York City—only ten miles away.

Its position as to drainage is on a divide which runs through and almost bisects its area on a line generally northwest and southeast, the northern slope being comparatively rapid, the southern slope very slight. Each slope is divided northeast and southwest by four parallel ridges and valleys which are more prominent near the central portion of the territory, but being very much reduced toward the northern and southern portions, the extreme northern portion being nearly seventy feet lower than the extreme southern portion.

The characteristics remain essentially the same today, as then, except that it now houses 26,000 people on its four square miles. Next to the City of Newark, its assessed valuation is larger than any other municipality in Essex County, of which it is a part.

In 1882 a water supply was furnished the township by an incorporated water company, and it soon became evident that wells and cesspools were doomed, the one as a source of supply, the other as a disposal of waste, and wise minds began to look about for a suitable plan of sewage disposal. The tide water, Passaic river, but little more than two miles away, was looked to with considerable interest, but the greater city lay between, with physical difficulties which appeared prohibitory, and local disposal seemed to be the only method which could be used. How little our wise men could see ahead will be shown later. Eminent engineers were consulted, plans for local disposal were prepared, and in 1886, four years after the water supply had been installed, a plan for sewers and sewage disposal was determined and adopted.

THE EXPERIMENT.

The plan provided for buildings in which settling tanks and proper machinery for handling sludge were to be placed, and about twenty acres of thoroughly drained land over which the treated sewage (after having been relieved of practically all solids by chemical precipitation) was to flow. The effluent from the under drains which ran into a large stream was expected to be pure water, and so, for a while it certainly was.

Two series of these settling tanks each were provided, and alternately one series to run about two weeks while the other series were being drawn off, the sludge gathered, strained and pressed.

THE EXPERIENCE.

It was expected by the engineer whose plan was adopted, that the expense of running the disposal works would be largely, if not entirely met by the sale of the pressed sludge for fertilizer. It took but a few weeks to demonstrate that the farmers of outlying townships were not only unwilling to pay for pressed sludge, but rather demanded pay for taking it away, and later, to refuse it altogether, because they satisfied themselves that its fertilizing value was almost nil. The result was that for the first three years the average annual cost of maintenance of the plant was $11,000.

Rosy reports were made each year of the increasing efficiency of the plant owing to better methods being introduced for the running of the plant, but each year the appropriations asked for the maintenance grew greater, the people in the immediate neighborhood insisted that objectionable odors could be noticed, and that under some conditions of atmosphere they were unbearable. Values of real estate dropped, and it became impossible to make real estate deals within the odorous radius; further, the neighboring townships through which the stream bearing the effluent sewage ran, found something wrong with the stream, protested vigorously and insisted that other means should be obtained to dispose of the sewage. In fact their insistence was so thorough that rather than face an injunction from the court preventing the use of the plant, the offending township was forced to seek other means of disposal.

Not only did the warning of the court force this conclusion, but it was duly reported to the citizens that at least $20,000 would be required for the coming year to run the plant with any degree of success and decency, with the prospect that each succeeding year would require increasing appropriations. Six years had gone by, and the plan of local disposal was condemned; $65,000 had been spent for the plant; $75,000 had been spent to maintain it. Money thrown away? Yes, but if the experience may prove beneficial to others, and that which proved disastrous to us may be an open path showing up the things to be avoided and the difficulties to be overcome, all has not been lost. Some communities might not be able to find some other method of disposal as we did, for in another two years, through the courtesy of the City of Newark, we were able to get a tide water outlet, and our troubles vanished in a night. It cost us $250,000 to do it, but interest and sinking fund are not so much as the annual cost of maintenance. We are no longer a nuisance to our neighbors, or a menace to the health of our own citizens. Our disposal works grounds make a beautiful little park, developed and maintained by the county.

The question here arises, was the installation of this disposal plant an experiment? Engineering advice before it was built said no; the plan was all right. In England, France and Germany, such plants were working with success, and this should do its work also, but it did not do it, and I question whether you could find one out of a thousand among those who were familiar with it, who could be made to believe that the whole thing was but an experiment from beginning to end, and an experiment which ended in failure. I am not of that belief, but realize that some difficult features of the sewers were overlooked in the beginning, and sufficient care was not used to overcome these difficulties when they appeared.

Few people realize what it means to make from 1,700 to 2,600 tight sewer joints to the mile in shaky bottoms, or in ground where the sewer is laid below the general water level.

Just what might have been the result if some other method of disposal could not have been secured, of course is problematical as seen from this time, but to have been enjoined from the use of the plant would have placed nearly 20,000 people in jeopardy of their health, and probably have hindered the growth of the city beyond measure.

I believe that the main difficulty, and the one which it was almost impossible to overcome, after the sewers had been built, was the excess of ground water which found its way into the sewers, with the result that the disposal plant could not carry it.

I am satisfied that the sewage itself did not amount to half of that which was poured into the tanks, consequently the tanks could not hold their contents long enough to secure a thorough settling of the solids, and allow the chemical action necessary to purify the water before it left the tanks to overflow the ground. The result was that the overflow from the tanks was almost invariably foul, and the odor could be detected within a quarter of a mile of the disposal grounds providing the wind was from the grounds towards any given quarter.

I believe the plant would have been a success if three conditions looking thereto had been carried out.

Two of them were almost vital, the other largely helpful.

Of the two, the practical elimination of the ground water comes first, a metered water system second, and a thorough system of surface and storm water drainage to supplement the other two.

That the elimination of the ground water is vital, you all undoubtedly agree; that a metered water system would have largely reduced the waste sent into the sewers, we know from experience of other places where it is used, that it would largely reduce the waste, while a thorough drainage system would have reduced the ground water, and thereby reduced the amount which might find its way to any faulty joints.

That the ground water was the main difficulty is more apparent today than in the first years of the system, for today much of the ground through which the valley lines were run, has been drained to such an extent that the water furnished to the sewers is much less than formerly, and today with a population of 26,000, the main outlet is carrying scarcely ten per cent. more flow than when first put in use, at which time the population was about 16,000.

If to this reduced flow of ground water, there could be a still greater reduction by the use of meters, we would probably find that there would not be more than one and one-half millions of gallons of sewage per day to be disposed of. This amount could have been handled at the disposal plant with comparatively little difficulty, and as the amount normally increased, other land which had been acquired, but which had not been prepared, could have been put in use.

Mr. Crandall: I did not quite catch whether the system in use was anything like that of the septic tank process so well known in England.

Mr. Reimer: No, sir, it was not a septic tank. It was simply two sets of three tanks each. The sewage ran into one, and when that was filled it ran over the edge and filled the next one, and by the time it got to the third one it was supposed to be pretty thoroughly clarified. Then it was carried by little channels on to the ground and spread over it at different points. It was simply a sort of a filtration system. The idea was that the solids would precipitate themselves to the bottom of the tank and that all that flowed over the edge of the third tank was pretty clear.

The President: Is there any further discussion on this paper? If not we will deal with Mr. F. W. Fitzpatrick's paper on "Buildings and Their Relation to Municipal Improvements." Mr. Fitzpatrick is not with us, but he has sent his paper. As the hour is getting somewhat late, I think we had better read it by title only, and incorporate it in the Proceedings.

Mr. Fitzpatrick's paper was as follows:

BUILDINGS—THEIR RELATION TO MUNICIPAL IMPROVEMENT.

BY F. W. FITZPATRICK, SECRETARY INTERNATIONAL SOCIETY OF BUILDING COMMISSIONERS.

Devise the most elaborate street plan you can, and let there be parks and boulevards galore; pave those streets as expensively as you wish;

install the finest water system known to engineering science, and let the sewerage, the lighting and all the "municipal improvements" be superlatively fine, yet without buildings what will your "city" be? Indeed, are not all those improvements but mere accessories, adjuncts, conveniences to the buildings And, according to the character, the importance, the utility and beauty of those buildings above all else, will your city be judged and assigned its place in the measurement of municipalities. Therefore, it is but just and meet that this convention of the American Society of Municipal Improvements devote some time to the consideration of that greatest of all municipal improvements—*buildings*. The only mistake the Society has made in the matter is in assigning a subject of such vast, o'ershadowing importance to one who, despite his keen appreciation of and his enthusiasm over it, can do the subject but such meagre justice.

At the very outset I may get myself into your bad graces by criticising the Society in that it has seemed, to me at least, to have fallen short of its high purpose by having comparatively neglected this main subject heretofore and devoted so much of its time and attention to the far less important matters of municipal improvements, franchises, public ownership, et cetera, et cetera, and I would exhort it with all the persuasiveness at my command to increase its efforts in that particular direction and strain its every energy to improve the conditions surrounding the very basic element of municipality.

Such effort would be timely. Other societies are awakening to a realization of the importance of the subject and the public generally seems to be getting into a more receptive frame of mind anent the matter. Some improvement may be noted all along the line. City after city shows at least a dawn of intelligence in the location of its own buildings and the citizens yield more gracefully to the rules set down for their guidance in erecting private buildings. The nation's capital has a commission of architects and artists (albeit unofficial and unpaid) to see to the artistic development of Washington; Cleveland has a similar commission that is doing splendid work; Chicago, Boston, St. Louis and other live cities have similar commissions under discussion. There was a time, and not so many years ago, when city hall, library or court house was planted down upon the lot whose owners or exploiters had the greatest political pull, regardless of the accessibility, centrality, or the harmonious blending of that building into a general scheme. Today most of our important cities, at least, are adopting something in the nature of a definite plan of development as to their buildings and in connection with parks, streets and the minor improvements. Architecturally, an integral part of the artistic development, a betterment is also perceptible. Look back fifteen or twenty years and you will find that public buildings, as a rule, were uglier by far than the ugliest of private efforts—and that is saying a great deal. Commissions were awarded architects through political influence, and mediocrity of design, if, indeed, those abortive attempts could be called designs, was the inevitable result. Today there is generally a competition fairly well managed and with competent judges, and if these or the municipal authorities allow themselves to be prejudiced and should select something that ought not pass muster, the great public (formerly known as the "unwashed") has become so discriminating that the officers derelict to their duty generally receive such a dressing down that such awards are frequently "reconsidered." Yes, there is an improvement all along the line. But it is slow, at best, and it behooves us who are so deeply interested and who, by reason of our membership in this very Society, have undertaken a certain responsibility toward the public, to redouble our efforts to better artistic conditions, improved though they be.

In the manner of construction has there also been some improvement? It is not so long ago that every individual felt that he had a perfect right to build as he wished, however perniciously his mode of building might effect his neighbor's property and the general welfare of his city. If he deemed it to his interests to build flimsy, "mere food for flames," he had a perfect right to do so legally. And it was about that time, too, that people laid sidewalks to suit themselves, of the material they wished, of the width they wished, and at the grade they particularly desired, so that you went up and down steps along the sidewalks of badly lighted streets, much to the discomfiture of gentlemen who had been attending night sessions of conventions or other such unbalancing functions. When cities began to regulate this matter of sidewalks, dictating of what material they should be, establishing uniform grades, and, indeed, doing the work to suit themselves and charging it up to the abutting property a howl went up against "interference" with private rights, the "liberty of the individual" was said to be assailed and it took time to make people realize that it was all for their own good. So with building regulations. When building codes first became the "fashion," much popular opposition was made to their passage. It was, indeed, an assailing of private rights, of individual liberty, paternalism running riot, an unwarranted interference with things which did not concern the municipality. Lately the public seems to have its eyes opened to the fact that good building is, in the long run, an economy to both city and individual, and it is only the Buddenseiks, the speculative builders, unprincipled rascals who build but for today in the hope of selling their whitened sepulchres to some unsuspecting innocent tomorrow, who oppose sane laws and throw obstacles in the way of their enforcement. Yet, unfortunately, these very men are a power, as we must perforce admit, because every wise law that is suggested certainly does meet with very violent though insidious opposition.

One of the greatest steps in real progress is the establishing of certain fire limits in cities and the compelling of every one building within those limits to do so in non-destructible construction. I say signs are hopeful, yet think of it, in all this great extent of the United States and Canada, there are scarce three thousand buildings that can be called even moderately fireproof, and fifteen hundred of those are congested in the city of Greater New York.

While I have the greatest sympathy with, and, indeed, work most zealously for the artistic development of our cities, I think we have per-preparation of my paper, until finally I had to rush it through and was not able to secure all the data I wanted for the proper presentation of the subject. I offer this as an apology for the rambling way in which the paper reads.

THE PRESIDENT: I think the simplest way of answering Mr. Hazlehurst is to say that his excellent paper is now open for discussion.

THE SECRETARY: I was interested in Hr. Hazlehurst's reference to the work that has been done in Memphis, Tenn., inasmuch as some of the first engineering work that I ever did was in that city, in 1880, when Colonel Waring made his arrangements for constructing the sewerage system. I went there together with an engineering force from all parts of the country, and there was a surprising amount of work done there from the first of February till the first of June, 1880.

The system was what was then called, and is now, a separate system, and all the laterals were six inches instead of eight, as I understood Mr. Hazlehurst to say the system is now.

It has been found that the six inch pipes are too small, and it has been found necessary to construct manholes at different points along the line, which were left out entirely in the original plan.

We went there in February, 1880, directly after a yellow fever epidemic, which raged in 1878 and 1879, and there were a great many pools of water scattered all over the place, and we were sure that in each of those pools there were millions of yellow fever germs. Soon after we arrived we heard of two or three deaths that had occurred after the victim had been stung twenty-four or thirty-six hours previously. We were told that they were not cases of yellow fever, but we decided that it did not make any difference whether it was yellow fever or not; that what we had to do was to get that work done as quickly as possible, or a good many of us might never get out of the place.

The situation there at the time was such that the merest rumor as to a case of yellow fever was sufficient to scare us out of our boots, so to speak.

I remember one line of houses there, and in the rear of the lots three old cesspools were encountered within a distance of one hundred feet. They looked as if they had just been covered over and left there. You can imagine the result in such a climate as that. Such cases as that were not uncommon all over the city where we were working.

I think it is almost incredible that a city with 40,000 inhabitants, such as Memphis was at that time, should be able to get along without being wiped out entirely, owing to the climate and the lack of sewerage arrangements.

The result of the work at that time, as you all know, was very successful. They have had practically no yellow fever in Memphis since that time. The drainage water was kept out of the sewers as much as possible. The idea was to make a water-tight joint, and this was accomplished by pressing a gasket of oakum into the joint as far as it would go, and then filling the joint with neat cement. It was thoroughly satisfactory. Where there was much water tiles were laid alongside the main pipe so that as much of the subsurface water as possible would be carried off in that way.

Memphis was peculiarly laid out, because it had lanes running north and south and east and west, and the blocks divided up were equal to a city block, and they were divided up into four sections, so that when the sewers were constructed in all the streets and alleys (as they were in pretty nearly the whole city), the place was thoroughly covered with branches of the sewerage system, and it must have been quite effective, and those tile drains must have been effective in draining the subsoil. However, it is a clayey soil, so that they would not drain anything like as much area as in some of the Northern cities.

THE PRESIDENT: If there is no further discussion on this paper we will proceed to the next one, which is entitled "Sewage Disposal, an Experiment and an Experience," by Mr. W. H. V. Reimer, City Engineer, East Orange, N. J. If Mr. Reimer is prepared to read his paper, we would be glad to hear him.

MR. REIMER: In presenting this paper it is not the intention of the writer to go into the pros and cons of sewage disposal, or to in in considerable latitude in the interior and fittings, but those conditions are remote. Your greatest danger is generally from within and therefore should everything be done to minimize that danger to the utmost. Just so much as your exposure increases should your precautions be greater, and, inversely, may you depart from the most stringent requirements as those conditions become more favorable.

The fashion is to criticise conditions, to carp at what is being done, to call attention to our wrongs and to heap vituperation upon our wrongdoers. That is all well enough, but let us, a body of intelligent men, not be satisfied with this mere preliminary, this campaign of destruction, this going after the enemy, but let us, shoulder to shoulder, work for the elimination of what is wrong and the upbuilding of a system, the creating of conditions, a campaign of construction, a cure for the wrongs that we deplore, and let us map out now a program, a scheme of work, to bring about the happy consummation of these much-to-be-desired reforms.

No society that has been organized purely for the public weal has as splendid an opportunity or is so well equipped to point out the way to reform and to insist upon the betterment of conditions than the American Society of Municipal Improvements. We should join our forces to the other societies that have organized a campaign of education looking to the betterment of building. Publicity, everlasting hammering through the newspapers particularly, public discussion and such means, easily available to this Society, constitute the best ways of securing the desired end. Let us clamor for the strictest building regulations. They work no hardship upon honest men. Let those regulations be so stringent as to virtually bar the possibility of fire damaging the new buildings, and they should surround the old with such safeguards as to lessen their danger to the minimum and make their maintenance so expensive to the individual that, dull of comprehension as he may be, it will soon be evident to him that a good building is more profitable than a poor one. Forbid him to add stories to his old ramshackle, or wings of similar construction. If he is not willing to obliterate the danger that exists with him, at least prevent him from increasing that danger. Let the building regulations be such as to prohibit experimental construction with its resultant collapses and loss of life. Clearly prescribe the right way and as definitely prescribe the wrong way of construction. Insist upon the executive officers, the building inspectors, having due authority to enforce these regulations, then exert your personal and Society influence to see that the right men receive the appointments to these offices, men who will understand the regulations and enforce their every requirement without fear, or favor, or political bias. Give attention to the sanitary equipment of those buildings, do not limit your interest to the taking care of the sewerage when it leaves the building, start it properly. Advocate sensible limitations in the height of buildings. A man is justified in increasing his building to its greatest reasonable productibility, but do not permit him to make a chasm of your streets. Get together and try and have your cities adopt some uniform code of building regulations, the one offered by the International Society of State and Municipal Building Commissioners and Inspectors, the advantages are legion. Harp upon the necessity of some intelligent and artistic general plan of your cities. It isn't necessary to start in tomorrow making beautiful parks here and there and spending millions in new public buildings but it is desirable to arrange a plan so that when a park is to be located or a building is to be erected it will merely occupy the place assigned it in that plan and will have some relation to the entity. Let all the efforts that are made, until the final consummation of the plan, be towards its completion. If a park is in question, keep buying the property, little by little, as it is for sale. And when appropriations are avilable for municipal buildings, jealously safeguard not only their construction, but their artistic excellence, position and conformity to the general scope and scheme of true municipal improvement. It is your duty as citizens and doubly so, being members of this Society, to devote considerable time and the greatest attention to all that concerns your city. Do not for one moment lose sight of the fact that we tried to establish at the outset of this perhaps too lengthy paper, that buildings constituted the largest part, the most prominent features of the municipality, and, therefore, deserve well of you.

One more thought, my lastly, gentlemen, and I will leave you to the consideration of perhaps more interesting papers, but certainly no more important subject. It is particularly fitting that I should mention this subject now and here, since the suggestion comes originally from Canada. You are much interested in taxation, in franchises, in the financial end of municipal business, hence is the matter of taxes upon buildings most pertinent. The municipality has the right to regulate, within certain well defined lines, its process and mode of taxation. It is to the municipalities' best interests that there should be no stagnation, no fossilization, no ruins and few relics within its borders. But what does it do towards eliminating or preventing these things? The municipality, without being philanthropic, must needs be socialistic. It exists by and for the people and not for the gain of the municipality as a governing body, or for any individual within it. Yet the whole system of municipal taxation could not be better devised were it planned to act as a drag, a deterrent to improvement. The more money you put into the betterment of any construction, or indeed the more business you do, the greater benefit you are to the municipality—and the more taxes you pay! In other words (and I quote my Canadian authority) "if a man taxes himself for the benefit of the public, it certainly is not fair to him to tax him again on the amount of his own taxation, but it would be quite fair to him and to everyone else to remit taxes to him on the basis of the account; and, inasmuch as taxes should be fluid and level up all hollows in the public estate, the displaced tax should find its settlement on buildings that are below proof in the matter of construction, fireproof and otherwise. It is for them and because of them that the costly fire department and water supplies have to be maintained, and they, and not the property which requires no protection, should pay for that maintenance." Would it not seem reasonable, therefore, to tax real estate along some well planned line of values as to location? As improvements are made upon the property, reduce the taxation in the ratio of that improvement's advantage to the municipality. If a citizen insists upon building a three or four-story fire-trap apartment house and the municipality has not been wise enough to make laws to prevent him from doing so, his tenants, in spite of him, have to be very carefully protected by the municipality. The city has to pay for that protection; his percentage of taxation is now exceedingly small compared to the amount of protection his property receives. On the other hand, suppose a citizen who is as public-spirited as he is wide awake to his own interests, builds upon a similar piece of property a thoroughly well built, fireproof structure. It requires the very minimum of protection from the municipality and is of not the slightest danger to its environing buildings. That man is a distinct benefit to the city, his taxation should be the very lowest. In the course of years his building deteriorates but very little and the tax upon his building should remain level. The other man's property is deteriorating very rapidly and becomes a greater menace as every year goes by. He doesn't tear down the building and rebuild it properly. He is satisfied with the interest he is making upon his investment and as far as the city is concerned, and his tenants, why, they may be hanged or burned for all he cares. That man's tax, I contend, should be increasing year by year, for he is costing the city more every day that the structure remains as a menace. The question of ratios is not an insuperable one, and the plan is not only sane, but I also contend, eminently feasible, just and commendable, Utopian as many of you may think it, it would be a distinct, a great step in the all-comprehending progressive municipal scheme, and well worthy inclusion in the splendid program of endeavor of the American Society of Municipal Improvements.

The President: We have another paper by Mr. E. J. Fort, on "The Organization and Conduct of a Bureau of Street Repairs for a City with a Population of 1,250,000." Mr. Fort is not with us, and I think we might just read his paper by title and print it in the Proceedings, then if there is any discussion, it can be held at the next meeting.

THE ORGANIZATION AND CONDUCT OF A BUREAU OF STREET REPAIRS FOR A CITY WITH A POPULATION OF 1,250,000.

BY E. J. FORT, ASST. ENGINEER, BUREAU OF SEWERS, BROOKLYN, N. Y.

Until very recently it has rarely been conceded by those in authority in American cities that street repairs is a proper field for the activities of an engineer. Notwithstanding the fact that his profession deals primarily with the economic side of matters, and that modern education provides thorough instruction in economics, and notwithstanding also, that his experience makes him capable of handling men, a butcher or a grocer or a tradesman of almost any kind, is usually preferred, when a head of the bureau of street repairs is required. So nearly universally is this true, that I believe the discussion of the subject of street repairs by such a Society as this is unusual and may prove to be interesting and instructive for that reason, if not for others.

It is considered such a simple matter to repair roads and pavements that no particular skill is required, and the position of superintendent of this bureau with an appropriate salary attached to it is usually considered a perquisite of the victorious political party. This was more generally true before the days of improved pavements. It must be conceded that little skill was required and less was shown in laying the old time cobblestone pavement. It is not extravagant to say that if all the money set aside for this purpose had been wisely spent for the purposes for which it was designed and under expert supervision, our cities today might be not only well paved but well served with other public utilities which make the crowded life of great metropolitan districts possible and even pleasant.

The Borough of Brooklyn of the City of New York, to whose street repair organization this paper refers, is somewhat of an exception to the rule in the manner in which this department of the public service is managed.

In January, 1902, the present bureau of highways, which previously, under the Greater New York charter had been a branch of the department of highways controlled by a deputy commissioner of highways, was organized as one of several separate bureaus, under the jurisdiction of the borough president whose heads reported to the commissioner of public works. The bureau of highways was placed entirely under the control of civil engineers. The chief engineer having control of all matters relating to the construction and repair of pavements and all matters relating to the laying out, opening, closing and improving streets and roads, etc.

An assistant engineer was placed in charge of the division of repairs of this bureau and the whole service was entirely reorganized.

The Borough of Brooklyn covers an area of 77½ square miles. Somewhat more than one-third of this territory is closely built up and contains fully four-fifths of the total population. A large suburban area is quite fully improved but does not contain a dense population, while nearly two-fifths of the whole borough is almost totally unimproved, and contains a rather sparse population.

Street systems are not yet indicated on the ground, much of which is still used for truck farming. Nearly all of this has now been acquired by improvement companies that are rapidly making the improvements necessary to convert it into suburban homesites.

In January, 1902, there were

216.8 miles of cobblestone pavements,
119.87 " " granite "
95.14 " " asphalt "
5.31 " " wooden block "
82.15 " " macadam "
47.39 " " belgian block "

making a total of 566.66 miles of paved streets and roads. In the suburbs there were several hundred miles of unpaved roadways.

In January, 1905, the above mileage had changed to the following:

113.73 miles of cobblestone pavements,
143.34 " " granite "
211.59 " " asphalt "
4.40 " " brick "
43.16 " " belgian block "
2.00 " " wooden block "
96.16 " " macadam "

Total, 614.38 miles.

Until 1901 the asphalt pavements were kept in repair by contract, as follows:

The various streets out of guarantee were grouped according to age and bids were submitted naming a price per square yard for the whole area in each group, for repairing and maintaining for one year. In 1900, the last year this method of keeping this pavement in repair was followed, the average cost to the city per square yard for repairs was 15.9 cents.

This method of calling for bids was thought to result in too great expense and in July, 1901, bids were called for naming a price per cubic foot for binder and wearing surface actually used in making repairs, and the reduction in cost to the city was so great that this method has since been followed.

In 1904 the prices bid for this material were:

Top..................85c per cubic foot.
Binder...............30c per cubic foot.

The average cost per square yard was 4.2 cents, a notable reduction from the former method.

It is probable that in 1905 there will be another reduction in the cost of asphalt repairs.

This contract is let in the winter and as soon as weather conditions are suitable in the spring the company which secures the contract commences work with a number of gangs of men (usually about 6) and usually within six weeks puts all asphalt pavements in repair. From that time throughout the season a few repair gangs are kept constantly at work going over the older pavements and repairing holes as they appear. The oldest pavements are sometimes repaired four times in a season.

Each repair gang usually consists of ten or twelve men, a foreman and a steam roller man. The number of trucks employed in hauling material to the street varies with the length of haul, but a gang of this size can usually lay 350 cubic feet of material per day, if the pavement is in ordinarily bad condition, and the distance over which the work is distributed is not too great.

An inspector for the city is present with each gang and marks with crayon the area of each patch to be cut out and measures the contents of each truck as it arrives on the work, takes its temperature, takes samples for analysis and otherwise supervise the laying of the material.

He makes a daily report to the office on a blank similar to the following one and a permanent record is made of the cost of repairs of each contract from year to year.

Report of Repairs to asphalt pavement on....................
between................and.................on.................190

	Total Amount Laid	Laid between tracks and Two Feet Outside
Binder,	.....loads,.....cu. ft.;	.....cu. ft.
Wearing surface after cutting out,	.....loads,.....cu. ft.;	.....cu. ft.
Wearing surface after using burner,	.....loads,.....cu. ft.;	.....cu. ft.
Standard asphalt pavement,	.....sq. yds.;	.....sq. yds.
Concrete foundation,	.....cu. yds.;	.....cu. yds.

Temperature of asphalt, highest,.....lowest,.....
Remarks ....
....
.....................................Inspector.

All openings made by plumbers and others are repaired by the same contractor at a price per square yard for the asphalt and per cubic yard for the concrete foundation.

These repairs are paid for from a fund accumulated from the regular charges for such openings—$13.00 for openings of less than 5 square yards, and $1.25 per square yard for all in excess of this. An inspector carefully measures all of these openings and makes the proper reports to the officer, from which the contractor is paid.

All openings made in pavements under guarantee are repaired by the contractor who laid the original pavement at the price bid for this pavement.

It should be said that the money spent for asphalt repairs represents the amount necessary to keep the asphalt pavements in good repair and not as is so often the case the amount the city can afford to spend or the officials are willing to appropriate for the purpose. All asphalt pavements are kept in good repair. Of course in the spring after months of weather which is unsuitable for laying asphalt some of the older asphalt pavements are badly out of repair, but during the remainder of the season this is not the case.

It may be of interest to note here that during 1904, asphalt pavements

1 year	out	of	guarantee	cost	00.0c	per	square	yard	for	repairs,
2 years	"	"	"	"	2.8	"	"	"	"	"
3 "	"	"	"	"	1.6	"	"	"	"	"
4 "	"	"	"	"	4.9	"	"	"	"	"
5 "	"	"	"	"	3.5	"	"	"	"	"
6 "	"	"	"	"	5.2	"	"	"	"	"
7 "	"	"	"	"	4.3	"	"	"	"	"
8 "	"	"	"	"	10.1	"	"	"	"	"
9 "	"	"	"	"	4.0	"	"	"	"	"
10 "	"	"	"	"	9.9	"	"	"	"	"
11 "	"	"	"	"	13.6	"	"	"	"	"
12 "	"	"	"	"	19.0	"	"	"	"	"

All other pavements out of guarantee are repaired by men employed by the city who are organized into gangs of suitable size, and provided with the necessary tools and materials.

In the built-up portion of the borough where nearly all of the pavements except macadam are laid, the repair force during the summer months consists of five large gangs of men containing each

1 Foreman,	at	$4.00	per	day.
4 Pavers,	"	4.96	"	"
2 Rammers,	"	3.84	"	"
13 Laborers,	"	2.00	"	"
4 Horses and carts,	"	3.50	"	"
1 Horse and wagon,	"	3.75	"	"
1 Team and truck,	"	5.00	"	"
Total................		$80.27		

Two small gangs of men containing each

1 Foreman,	at	$4.00	per	day.
2 Pavers,	"	4.96	"	"
1 Rammer,	"	3.84	"	"
6 Laborers,	"	2.00	"	"
3 Horses and carts,	"	3.50	"	"
1 Horse and wagon,	"	3.75	"	"
Total................		$44.01		

One street cleaning gang containing

1 Foreman,	at	$4.00	per	day.
6 Laborers,	"	2.00	"	"
5 Teams and trucks,	"	5.00	"	"
1 Horse and wagon,	"	3.75	"	"
Total................		$44.75		

Nine sidewalk repair gangs containing each

1 Flagger and curbsetter,	at $4.50 per day.
1 Helper,	" 2.00 " "
1 Horse and wagon,	" 3.75 " "
Total................	$10.25

In addition to the above force one gang of men is constantly employed with concrete mixer laying cement sidewalks and concrete foundations for pavements. This gang consists of

1 Foreman,	at $4.00 per day.
8 to 25 Laborers,	" 2.00 " "
6 to 10 Teams and trucks,	" 5.00 " "
3 Cement workers,	" 2.50 " "
Total................	$57.50 to $161.50,

depending upon the character of the work.

There are also six connection gangs containing each

1 Foreman,	at $4.00 per day.
1 Paver,	" 4.96 " "
1 Rammer,	" 3.84 " "
3 Laborers,	" 2.00 " "
1 Horse and wagon,	" 3.75 " "
Total................	$22.55

There are also

3 Assistant foreman,	at $4.50 per day.
6 Watchmen,	" 2.00 " "
1 General foreman,	" 5.00 " "

who supervises repair work in the whole borough.

There are six corporation yards in this portion of the city where material, such as paving blocks, sand, broken stone, cement, paving pitch and tools and machines are stored for the use and convenience of these repair gangs. A watchman is stationed at each of these yards who keeps account of all material received and sent to each gang. He also keeps an account of all tools stored at the yard and charges each foreman with tools furnished to his gang. These tools must all be accounted for at the end of the season's work.

The book kept by the watchman is as follows:

BUREAU OF HIGHWAYS. Borough of Brooklyn, City of New York.

.... *190*

FOREMAN'S RECORD OF MATERIAL RECEIVED at Corporation Yard at............., ...190

From Whom Received	Material	For What Purpose	Quantity	Condition—Quality	Remarks
					Foreman

The large repair gangs are engaged almost entirely in relaying block pavements that have become so badly out of repair that they cannot be put in good condition without relaying entirely. It has been found that a gang proportioned in this way works to the best advantage at this class of work. The average width of roadway is about 32 feet, and 4 pavers have plenty of room to work without interference. Two rammers are able to ram and otherwise adjust all the blocks that four pavers can lay. Of the 13 laborers, four are usually employed in barring out and removing the old blocks, three or four men are employed in carrying blocks to the pavers and the remainder in picking and grading the earth foundation.

The repair gangs having two pavers are employed in making small repairs in block pavements. Where a pavement is in fair condition, having only here and there a hole or depression, or where only a small portion of the pavement must be relaid to put the street in good condition, a gang of this size can be employed to the best advantage because a larger one would be scattered so much that the foreman could not have proper control over all the men. The connection gangs are employed in restoring the pavement over openings made in block pavements for the purpose of making water, sewer, gas and electric connections. They also repair all dangerous holes reported to the office. Not all of the connection openings are restored in this way. The gas and electric companies are allowed to restore much of the pavement removed by them for this purpose and no charge except for inspection is made by the city for the privilege of making the openings.

A district comprising about one-sixth of the paved area of the borough is allotted to each connection foreman and his work is confined to that district almost exclusively.

Each paver is required to pave as a day's work
45 square yards of granite blocks, or
45 square yards of Belgian blocks, or
60 square yards of cobblestone pavement.

There is very little brick pavement in the borough and the wooden block and the greater portion of the asphalt block pavement is still under guarantee, so that the amount required for a day's work is not fixed.

The foreman makes a written report upon the following blank each day, giving the force employed, the amount of work done and the materials used:

..............190 **Foreman's Daily Report.**

BUREAU OF HIGHWAYS, BOROUGH OF BROOKLYN

Room 19, Municipal Building.

Connections Paved or Repaired Street Repairs Sunken Connections, etc.

No. of Permit	Date of Permit	KIND	LOCATION	CLASS	LOCATION	Sq. Yds Paved	Loads of Sand	Loads of Stone
					.... *Foreman.*			

This information is recorded in the office and the cost per square yard is figured as soon as the work is finished. Every foreman is thus kept in competition with every other foreman and expensive work is detected at once.

The area of pavement removed for a connection opening averages about 4.2 square yards. The connection gangs are required to move from place to place so constantly in their work that they are not able to restore as much pavement as if this were not the case. The average day's work for one of these gangs is ten openings, or about 42 square yards of pavement.

The method followed in making and restoring these openings is as follows:

The plumber obtains the necessary permit for making the connection from the proper department and pays the regular fee. He then obtains a permit from the bureau of highways to open the pavement and pays the fee required for restoring it. This money, as it accumulates, is kept as a separate fund and is spent for the wages of the men employed to restore the pavement. A report is made to the bureau of highways after each connection opening is made by the department, or bureau which granted the original permit. Ten days after the opening is made an order to repave it is given to the foreman in whose district it happens to be.

This method of procedure has been so well systematized that not more than two or three openings out of 12,000 per year fail of being repaired promptly. The foreman returns the list of connection openings paved each day in his daily report. A permanent record is then made of the location of the opening, the date when made and when repaired, by whom made, etc.

Reports are made daily by the departments of police and street cleaning of all holes in the pavement, dangerous or otherwise, which have been found by employes of these departments and they are given to foremen of connection gangs to repair. These foremen communicate with the office every day by telephone at a given hour for the purpose of receiving notice of such holes and for other purposes. Several thousands of holes are repaired in this way each year. It is customary to repair them within 24 hours from the time they are received at the office. They occur in great numbers over all trenches and connection openings. More than 100 are commonly reported after a heavy storm.

During the winter months all of the repair gangs are laid off and the connection gangs are doubled in number. They are employed in making temporary repairs to dangerous holes, sprinkling sand on icy walks and pavements, cleaning snow and ice from walks in front of city property, cleaning suburban roads after storms, providing surface drainage as far as possible where no sewers have been built and doing a multitude of things for which they seem to be most available.

The street cleaning gang follows the repair gang and after an interval of 15 days from the time repairs are made, cleans away the sand with which the newly laid pavement has been covered.

Up to the present time almost all the pavements laid with a concrete foundation are so new that only slight repairs are necessary. The repair gangs therefore are engaged almost entirely with the old granite block, Belgian block and cobblestone pavements. The present organization of the gang need not be greatly changed, however, when these old pavements are entirely replaced, as we may reasonably predict that they will be in a few years.

The flaggers are employed in making repairs to curb, crosswalks and flagging. They make daily reports to the office and are held to strict account for the quantity and quality of work which they do.

During the winter months a small stone crusher is operated at one of the corporation yards and a good supply of broken stone for concrete foundations for pavements and sidewalks is at hand in the spring.

The cost of crushing this stone has been about 60 cents per cubic yard. Contractors are required to deliver free of charge at the nearest corporation yard any old material required by the city. A large quantity of second hand blocks, bridging and cobblestone is in this way usually hauled to these yards for use in repairs and for crushing.

In a few years when the old pavements have been entirely replaced this crusher will no longer be of use.

In 1903 a little more than 30,000 square yards of granite block pavement on a concrete foundation was laid by the repair force in place of old cobble pavement which was removed. The cobblestones were hauled to the crusher and crushed and used in the concrete foundation. The granite used came from nearby streets that were being paved with asphalt and was delivered by the contractor without cost to the city. Sand was delivered on the street by contract at a price per cubic yard. The cost of this work was $2.10 per square yard. When new blocks were used this cost was $3.54 per square yard. The average cost of such work done by contract in the same year was $3.56 per square yard. Some work of this kind was done the following season, but usually the saving over the results obtained by contract, if there is any, is so small and the appropriations for contract work have been so liberal that it has seemed wiser to expend all money appropriated for repairs proper and not for repaving.

It should be mentioned, in comparing the cost of this work when done by contract and when done by day's labor, that the contractor pays $1.50 for ten hours' labor, while the city pays $2.00 for eight hours' labor. Then, too, the contractor chooses his own men, while the engineer in charge of such work takes the men, teams, etc., that are sent to him without discretion.

The city buys its material, such as cement, sand, etc., by contract frequently when the market is unfavorable, while the contractor buys at his convenience when the market is favorable, and can almost invariably obtain lower prices.

The difference in these items should be sufficient for a handsome profit to the contractor.

In the suburban portion of the borough the repair force consists of

(A.) Four gangs of men containing each

1 Foreman,	at $4.00	per day.
8 Laborers,	" 2.00	" "
1 Horse and wagon,	" 3.75	" "
4 Horses and carts,	" 3.50	" "
2 Teams and trucks,	" 5.00	" "
Total................	$47.50	

(B.) Two gangs of men containing each

1 Foreman,	at $4.00	per day.
10 Laborers,	" 2.00	" "
1 Horse and wagon,	" 3.75	" "
4 Teams and trucks,	" 5.00	" "
4 Horses and carts,	" 3.50	" "
Total................	$61.75	

(C.) Three gangs of men containing each

1 Foreman,	at $4.00	per day.
12 Laborers,	" 2.00	" "
1 Horse and wagon,	" 3.75	" "
3 Horses and carts,	" 3.50	" "
1 Steam roller engineer,	" 3.50	" "
1 Team and sprinkling cart,	" 5.00	" "
Total................	$50.75	

(D.)	1 Assistant foreman,	at $3.00 per day.
	22 Teams with sprinkling carts,	" 5.00 " · "
	Total..............	$113.00

One assistant general foreman at $4.50 per day has immediate supervision of this suburban force.

The four repair gangs first mentioned are employed entirely in repairing dirt roads and are provided with an ordinary blade road machine. This machine is hauled by two teams, and, when the soil is free from stone and tough sod, should be able to repair 1,000 feet of roadway per day. The laborers are then only required to make what small repairs the machine neglects, clean and grade the gutters and to dispose of sod and other debris. Much of the work of these gangs, however, is filling holes and washouts and doing small jobs of grading when the machine is of no use, so that the average amount of roadway repaired per day is much less than 1,000 feet.

The two gangs designated (B) are employed in cleaning macadam pavements. They are each provided with an A. B. C. macadam scraper and a street sweeping machine. The lineal feet of roadway one of these gangs clean per day depends entirely upon its condition and the width of roadway, the length of haul for the sweepings, etc., so that no fixed amount constitutes a day's work. In the most remote and unfrequented portions of the borough the macadam pavements are not cleaned more than twice per season. In the best part of the suburbs they are cleaned once per week. Where the roadway is provided with a curb they are swept and cleaned much as any other pavement is cleaned, but where no curb is set the grass and weeds are cut up with a road machine and the gutter is graded only.

The three gangs designated (C) are employed each with a steam roller in making repairs to macadam pavements. The macadam roads—the only paved highways in the suburbs were many of them paved several years ago with limestone and as they become quite thoroughly worn out they are resurfaced with trap rock. Contracts are let each winter for this material at a price per cubic yard delivered on the street. This price for the last few seasons has averaged about $1.65 per cubic yard; 27,900 cubic yards 1½ broken stone and screenings were bought for this work in 1905, which it is thought will repave about 11 miles of roadway. A gang organized as above should finish at most about 500 square yards per day. The gang usually works about as follows: Five or six men are required to spread stone, two (2) men with horse and cart each are required to spread screenings, and the remaining men and horses and carts are required to clean and prepare the roadway to receive the stone. The cost of this work is usually about 9 cents per square yard per inch in depth of finished work. This compares very favorably in price with the results obtained by contract and the quality of the pavement obtained is fully as good as can be obtained in any other way, so that the policy of the bureau of owning its own steam rollers and doing its own macadam repair work has proved to be a complete success.

Eighteen sprinkling carts owned by the bureau and under the supervision of an assistant foreman are employed in sprinkling macadam roads. Only a part of these roads, the most frequent thoroughfares and those in the most closely built up districts can be sprinkled by this number of carts.

A certain length of roadway is allotted to each sprinkling cart and the driver is held responsible for the condition of this roadway. It is considered that one cart is able to sprinkle properly about two miles of roadway 15 or 18 feet in width, if hydrants are located at points convenient to the work. In a working day of 8 hours one cart should deliver at least 35 loads of water of 600 gallons each upon the street. If the team walks at a reasonable speed, one cart load should cover about 600 feet. In those portions of the suburbs that are highly improved the roadways are much wider than 18 feet and must be sprinkled several times per day in order to lay the dust completely. This sprinkling is continued for about 200 days per season. Outside of the comfort afforded the residents, who otherwise would be very unhappy and uncomfortable, because of the dust, it is undobutedly of great benefit to the pavements themselves, as they would ravel and deteriorate rapidly from traffic were they not sprinkled.

The foreman in charge of this work is provided with a bicycle and visits each sprinkling wagon at least twice each day.

The general foreman, who, under the direction of the assistant engineer in charge of street repairs, has charge of all of the repair force, is provided with a horse and carriage and spends all of his time practically supervising the work in the streets. He is able to visit every gang of men about every two days.

Each assistant general foreman has charge (under the general foreman) of repairs in a certain district. He is supposed to be thoroughly familiar with the condition of the pavement on every street in his district, and is held responsible for the amount and character of work done by repair gangs in that district. It is his duty also to locate and repair promptly all defects in the pavement that have escaped the attention of the police and street cleaners.

The assistant engineer in charge is provided with a small automobile and chaffeur to care for it. This machine has proved to be more efficient and economical than horses for this work and more of them will no doubt be introduced in other departments for work requiring much travel.

Weekly, quarterly and yearly reports are made to the chief engineer and by him to the commissioner of public works of the operations of this division of the bureau.

Including the fund accumulated from charges for plumbers and corporation openings, the amount annually appropriated for labor maintenance and supplies for the bureau of highways is about $485,000. The large part of this (about $360,000) is spent for the purpose of street repairs.

A few years ago when cobblestones formed the great majority of all the pavements, this sum was entirely insufficient to keep them in repair.

Where traffic was heavy they could not be made to stay in repair any length of time and almost any amount of money could be spent in the effort to put them in good condition. Recent large bond issues by the city for repaving have nearly transformed the borough from one of the worst paved cities in the world to one of the best, and have enabled the bureau with this appropriation to put the remaining old pavements in good condition.

The problem of street repairs would be greatly simplified if the pavements were not constantly torn up by corporations for the purpose of laying gas mains and connections, electric light, and telephone conduits, repaving street car tracks and cables and by contractors for the purpose of laying water mains and sewers; by plumbers for the purpose of making water, sewer and gas connections and by others for almost every conceivable purpose.

In 1904, 78,272 connection openings of all kinds and 37 miles of trenches for water mains alone were opened in the paved streets.

The length of trenches opened by gas companies, sewer contractors, electric and other companies is not exactly known, but it was very large.

These trenches and openings are seldom properly tamped when they are refilled and invariably settle enough to destroy the smooth surface of the pavement, and no matter how carefully the repairs are made the pavement is never as good as it was originally. After a few trenches have been dug through it, it must be entirely relaid to restore it to its former condition.

Legitimate wear from the wheels of vehicles and the feet of horses is not in most cases the greatest factor in the destruction of a good pavement.

The day when all or nearly all subsurface structures in the borough or the city may be placed in conduits built for that purpose seems far off and the subsurface of the streets bid fair to become more and more closely occupied by such structures until, as at present in some parts of Manhattan, it is a difficult problem to find room for more.

Its value in use is the only true measure of the worth of a pavement. This value depends nearly as much upon the state of repair in which it is kept as upon the manner in which it is built. It is certainly less expensive to keep pavements in good than in poor condition and their life will be much longer.

Few things improve the general appearance of a city more and give a better general impression than nicely paved streets.

The condition of the pavement is something of an index to the character of the people. It has a direct bearing upon their physical, mental and moral welfare. It is noticeable that after a new clean pavement has been laid, people are more careful of their personal appearance and the children become more addicted to the use of soap and water.

As in other undertakings, good work implies good organization. The laying of a modern pavement requires some skill and this skill is acquired only by experience.

A system of civil service which insures reasonably continuous employment is therefore necessary.

If every man is given a living interest in his work and made to feel the importance of it, the question of organization is easily solved.

The organization below is not submitted as an example of a perfect one or one that would be suitable for all cities of this size. It is no doubt capable of improvement, but it has proven sufficient for its purpose in Brooklyn and its members quite generally feel that their occupation is a desirable one and that they are doing an essential and important part in providing the modern utilities and wholesome surroundings that science decrees to be necessary to preserve the intellectual and physical stamina of the race as the movement of population toward the cities steadily increases.

Assistant Engineer in Charge

- Chief Clerk
- Complaint Clerk
- Record Clerk
- Pay Roll Clerk
- Gen'l Foreman
  - Asst. Gen'l Foreman
  - Asst. Gen'l Foreman
  - Asst. Gen'l Foreman
  - Asst. Gen'l Foreman
- Asst. Engineer

- 5 Repair gangs
  - 1 Foreman
  - 4 Pavers
  - 2 Rammers
  - 13 Laborers
  - 4 Horses and carts
  - 1 Team and truck
  - 1 Horse and wagon
- 2 Repair gangs
  - 1 Foreman
  - 2 Pavers
  - 1 Rammer
  - 6 Laborers
  - 3 Horses and carts
  - 1 Horse and wagon
- 1 Street cleaning gang
  - 1 Foreman
  - 6 Laborers
  - 5 Teams and trucks
  - 3 Horses and carts
  - 1 Horse and wagon
- 1 Sidewalk repair gang
  - 1 Foreman
  - 10 Laborers
  - 4 Teams and trucks
  - 2 Horses and carts
  - 1 Horse and wagon
- 6 Connection gangs
  - 1 Foreman
  - 1 Paver
  - 1 Rammer
  - 3 Laborers
  - 1 Horse and wagon
- 5 Material yards
  - 1 Watchman
  - 1 Laborer
- 3 Macadam repair gangs
  - 1 Foreman
  - 1 Steam roller engineer
  - 14 Laborers
  - 1 Horse and wagon
  - 4 Horses and carts
  - 1 Team & spri'kling cart
- 2 Macadam cleaning gangs
  - 1 Foreman
  - 10 Laborers
  - 2 Teams and trucks
  - 4 Horses and carts
  - 1 Horse and wagon
- 4 Repair gangs, dirt roads
  - 1 Foreman
  - 6 Laborers
  - 1 Horse and wagon
  - 2 Teams and trucks
  - 3 Horses and carts
- 18 Sprinkling carts
  - 1 Foreman
  - 18 Laborers
- 2 Material yards
  - 1 Watchman
  - 1 Laborer

Total force when recruited to its full strength and including all men assigned special work and not shown above about 500.

THE PRESIDENT: With becoming modesty Mr. Chausse has left his paper for last. He wishes me to apologize for him not being able to read it personally on account of his voice being out of trim this evening. This being the case, perhaps we can excuse him, and I will read his paper to you.

The President then read Mr. Chausse's paper, as follows:

OUR SINFUL EXTRAVAGANCE—THE NEED OF STRICTER BUILDING REGULATIONS.

BY ALCIDE CHAUSSE, MONTREAL.

Architect and Building Inspector of Montreal, and Vice-President International Society of Building Inspectors.

This North America of ours is vast indeed; our natural resources are great, and we have grown to look upon them as inexhaustible. With ruthless abandon we have devastated our forests; we have worked our lands beyond endurance; our mines, our fields are handled without regard for the morrow. Within but a few years our economists have called our attention to this useless waste, and indeed we find ourselves confronted by a scarcity of certain commodities hitherto thought unlimited. People are just beginning to awaken to the true condition of things.

But of all the useless wastes that we, as a people, have indulged in, in the United States and in Canada, that of fire—our annual bonfire—is the most inane, in fact criminal, for by it is property not only devastated but lives by thousands yearly sacrificed.

Think of it! In 1904, 7,000 people were burned, an average of 19 fatalities through fire every day in the year, and a record that nearly equals that of all the railroad accidents of the two countries, generally considered the most fruitful source by far of fatal accidents. And the record of 1904 was not an extraordinary one, the increase in deaths by fire has been growing steadily. Our present ratio is about nine lives lost by fire every year for every one hundred thousand of population. In 1900 the ratio was eight, and in 1890 it was five. Unless something drastic be done, what will be the ratio in 1950

If the loss of life is appalling, the loss of property is disgusting. One hates to think that he is part and parcel of such a race of stpuids. Not even China and Japan, with their paper and bamboo houses, submit to such a tax as we do. Our fire losses are equal to a tax of $25 per year per family, and that tax shows but the loss of property actually consumed. We have burned up one thousand million dollars worth in six years. Most losses, so called, are really but exchanges; one product turned into some other form; a loss perhaps to many, but a gain to some. Not so with fire. That loss is final, absolute, and the visual one is actual. The only gain to anyone is an indirect one to the insurance companies who profit just so much more by the added anxiety after a fire that people have to be insured, and the insurance business is not run upon strictly philanthropic lines. The result of the transformation caused by fire is nothing but smoke—$230,000,000 worth of smoke last year. As with last year's death record the property loss does not show a spasmodic increase or something very extraordinary and unlikely to happen again. Even including the Baltimore fire it was but little over the regular increase, a record that has been climbing ever upward—a record that hovered about the 60 million figure in the '70's, the 100 million in the '80.'s, and one that has not been under the 160 million limit since 1900.

And, mark you, that is the destruction of property. Along with that we throw away $150,000,000 or so additional in maintaining and perfecting water plants and fire departments, salves to assauge the pain of the sore, not a cure for the malady. Then, on top of that we go to work and gamble with the fire insurance companies and pay out countless millions more, so that they will reimburse us individually should we suffer a loss through fire.

For every dollar that the individual loser receives as indemnity, the community has paid out three dollars as insurance premiums. That is the average. I have in mind one city that has paid out in a given time $692,000 in premiums, and that has gotten back $107,000 for its losses by fire during the same period. An intelligent speculation to be sure, but then, what gambling is intelligent?

But leaving aside the accessories so to speak, and restricting ourselves to the actual destruction of property, the $230,000,000 of last year means a daily average of $630,000. Now, large as that is, we were satisfied some time ago that it did not tell all the story. We draw those facts from the fire department records, insurance reports, etc., more or less fallible sources of information, and that are far from being all-comprehending. We were sure that there were hundreds of fires unreported in interior districts of uninsured property, and where there were no fire departments. So, early in February of this year, the Society of Building Commissioners and Inspectors prepared a most elaborate system albeit expensive, to get all the facts concerning fire for at least a short period. The system was in working order by February 19, and was, I am sure, perfect on the 23rd.

During the ten days of the test, from February 19 to 28, there were 1,315 fires, totalling a loss of $14,809,000, or one and a half million dollars a day. True, it so happened that there were some pretty severe fires during that period, but, who tells us that there will not be as severe, or more severe ones later on during the year as there was previous to that time?

Granted that the record of a million and a half a day will not obtain the year round, and assuming indeed that we will not actually average more than half the amount, still the figure is exceedingly near the mark reached by the new buildings we are daily erecting and that give such a semblance of progress, indeed a boom. At the most liberal estimate we build but a million dollars worth of buildings a day, hence we are destroying perilously near as much as we are creating. Talk of race suicide!

New York averages 8,700 fires a year; Chicago 4,100. We burn up three theaters, three public halls, twelve churches, ten schools, two hospitals, two asylums, two colleges, six apartment houses, three department stores, two jails, twenty-six hotels, one hundred and forty flat houses, and nearly sixteen hundred homes every week of the year. We may say that every person who lives or has business in buildings is more or less exposed to danger by fire, owing to our recklessness or criminal carelessness or ignorance, but setting aside such broad terms we have estimates that there are 36,000 lives daily in danger, that is, there are that many people directly exposed to fire—people who escape from burning buildings—lives that are in imminent peril. No war, however bloody, shows any such average of lives daily exposed to destruction.

And what is being done to prevent this terrible loss? A little—almost hopelessly little in the way of prevention, though much as a palliative. We throw water upon our fires (we are constantly endeavoring to throw it more scientifically) and expect the next fire to burn less fiercely because thereof. In San Francisco, for instance, there is little being done comparatively to improve the standard of construction. It is notoriously a wooden city, yet insurance rates are fairly low, because, forsooth, the *fire department is so excellent*. That is like extolling the advantages of a certain locality as a health resort. It may be miasmatic, yellow fever may stalk amuck; its houses and streets may be foul, but, glory be, its doctors are skillful.

As far as cure goes, note how little we have done. In all this broad land there are but three thousand buildings that can be called "fireproof," and that very largely only in their structural parts, that is, fireproof buildings like those in Baltimore, whose steel frames and terra cotta floors withstood the attack where all else about them, the stones, the marble, the wood, went the way of all things combustible or destructible.

What is the cure? But two things will tend toward the accomplishment of that end, and neither water supply nor fire department is one of them. The first thing to do is to surround our old and dangerous buildings with safeguards, to correct their worst faults where practicable, and to compel their demolition as soon as possible. The second is to absolutely bar the erection of combustible structures in the future.

Some would say that that would be a hardship upon the individual, for we have grown so accustomed to using wood that it seems to be a fixed mode of construction, sanctioned by time and custom, a sacred inheritance, any tampering with which must needs savor of sacrilege. Therein the folly.

There was a time when wood construction was true economy, indeed the only thing available. Today wood is almost a luxury. Lumber has gone up so much in price (over 150 per cent. in the last few years), while the fireproof materials, brick, steel, fireproofing tile, cement, etc., have been cheapened in cost of manufacture. There is absolutely no economy in building even a simple cottage of wood. Granted that the first cost in the fireproof material is 10 per cent. more than wood, but consider the wear and tear, the maintenance, the insurance and all those incidentals, and your frame cottage will have cost you in twenty years' time 30 per cent. more than a well built non-inflammable structure would have done.

The deterioration in the value of a well built fireproof building, fire resisting in its finish and decoration is but one-ninth of 1 per cent. a year, while that of the ordinary wood joists and stud partition affair is nearly 4 per cent. a year. Besides such improved construction has a host of other advantages. Sound proof, vermin proof, warmer in winter and cooler in summer, and in every respect superior to the old way of building.

Some weak hearted ones would have us believe that to bring about those two conditions would involve superhuman effort, well nigh an impossibility. But, our cities have accomplished other reforms quite as revolutionary, so thought at the time, as this would seem to be. The people sometimes chafe at what they term the restrain of individual liberty, involved in the enforcement of drastic curative laws. But not for long. North American intelligence is such as to soon recognize the value of perhaps individual sacrifice involved in a great public benefit. We may not hope, however, to bring the desired conditions about by mild persuasion, preaching. It will take vigorous action, and the only action that will accomplish anything is the adoption of most stringent building regulations, and their strict enforcement by competent executive officers.

Building in general terms requires the clearest definition and restriction, while every class of building calls for a thoughtful and comprehensive special legislation. If we think that theater builders ought to enjoy certain latitude, we have but to scan the record of the Iroquois theater. If it be suggested that dock sheds are hardly worthy of special legislation, think of what happened at New Orleans. If wholesale warehouses be deemed unimportant, note what happened in Toronto. And so it is with every class of building. Nothing can be deemed unimportant, for that very building or class of buildings, may prove the ruin of half your city.

Strict building regulations, I say, are all important and supremely necessary. Two hundred and sixty-four of our American and Canadian cities have realized that, for there either have been, or are being adopted perfected building regulations in that many cities. One hundred and sixteen cities or considerable towns heretofore unprovided with a special building officer or department have the creation of such office under consideration. There are happy indices of betterment, however we may look, thank Heaven, but it is just such societies as this, made up of thinking, public spirited men, zealous in the upbuilding of their several municipalities that can do a world of good in facilitating this work, and bringing its consummation about even in our own times.

Of all the cities that have given most thought and earnest work to this matter, Cleveland easily takes the lead. Her building ordinance may be said to be the combined work of nearly all the building experts in the country. A vast sum was spent upon its preparation, every item was discussed by experts and its effect upon the legal side of the question as well as the technical were carefully weighed by specialists, and the society of which I am an officer, the International Society of Building Commissioners and Inspectors, has virtually advocated that ordinance in toto as its model and standard, and is urging every city in both countries to adopt it also with as little change as possible.

Some may think it verbose. It is complete, and leaves nothing to the misinterpretation or misjudgment of a perhaps too lax officer. Every point is covered.

I submit, and you will readily appreciate that it would be a tremedous advantage to have a uniform code throughout both countries. As it is now one city will permit of a certain thickness of brick walls to carry a certain height of stories; a city fifteen miles distant therefrom insists upon an entirely different standard. So it is with allowable strains in framing, etc. The building business of all the cities in so closely related that this everlasting difference is not only confusing but leads to endless discussion and trouble. A hundred other considerations should compel us to advocate not only good building regulations, but uniform ones, and I sincerely trust that each one of you gentlemen will not only advocate in his own city the necessity of wise and strict requirements, but that he will go a step farther and strongly urge the council, or whatever power is in charge of that branch of municipal service, to adopt the code that is most worthy of being made standard, and that has already been engrossed upon the laws of so many of the cities of these United States and Canada.

THE PRESIDENT: This completes the "literary" portion of the evening. There is still some little business to be transacted, and then we are through.

MR. SHERRERD: Mr. Phillips was obliged to leave town today, but there were some questions that we wished to ask in connection with street paving. I will ask the privilege of referring those questions to the Committee on Street Pavements, and they can be discussed at the next meeting.

THE SECRETARY: I would move, Mr. President, that the thanks of this Society be tendered to the following persons and companies for the manner in which they have provided for our entertainment, and the care they have taken of us while we have been here:

The Mayor and members of the City Council.
The members of the Fire and Light Committees.
The Montreal Street Railway Company.

The Canadian Pacific Railway Company.
The Montreal Terminal Railway Company.
McGill University.
The Bell Telephone Company.
Mr. George Gauvreau, of Theatre National.
The Sparrow Theater and Amusement Co.
The Chateau de Ramezay Committee.
Rev. Abbe Thoie of Notre Dame.
Prof. J. C. Dussault, organist of Notre Dame.
Mr. Levi Tremblay of Riverside Park.
Mr. Joseph Langlois of St. Helen's Island Ferry.
The Canadian Municipal Journal.
The Municipal News.
Municipal Journal and Engineer of New York.
The newspapers of Montreal.
The readers of papers who are not members of our Society.
Harbor Commissioners of Montreal.
Canadian Society of Civil Engineers.
Ladies of Montreal on Reception Committee.
Engineers' Club of Montreal.

THE PRESIDENT: I think that Mr. Chausse and Mr. Barlow deserve a special word of thanks from this Society for the trouble they have taken in connection with making a success of this meeting.

MR. O'BRIEN: I agree entirely with our President, and if he will make a motion that the special thanks of the Society be extended to Mr. Chausse and Mr. Barlow, I will second it with pleasure.

THE PRESIDENT: Mr. Chausse and Mr. Barlow, it has been regularly moved and seconded that the special thanks of this Society be extended to you for the work you have done during the past year, particularly in arranging the details of this meeting, the success of which is due almost entirely to you.

MR. CHAUSSE: I am somewhat taken by surprise by this, Mr. President. As you know I am not much of a speech maker, but I thank you very much for your kind words. I only tried to do as I promised you at St. Louis last year. You will remember that I told you if you came to Montreal we would try to increase the membership and give you a rather good time. If I have been able to help in doing either of those things, I feel amply repaid for any trouble I have taken.

I thank you, gentlemen.

MR. BARLOW: I have not anything to add to what Mr. Chausse has said. He has done most of the work, and, I think, is entitled to most of the thanks. The part that Mr. Barlow took in it was comparatively small. I thank you for your kind words, however, and assure you that if it ever happens that I have an opportunity again (and I hope it will) you will find me ready and willing to do what I can to make the meetings as great a success as this one has been.

MR. SLATTERY: Coming as I do from Newfoundland, and this being the first convention of this nature that I have attended, I have been very much interested in the proceedings.

A great many new matters have been brought to my notice here, and I have collected a great deal of information which will prove most valuable to me, and I shall go home very much enlightened on many points.

But that was not why I stood up to speak, gentlemen. What I wish to do is to propose a hearty vote of thanks to our President for the able manner in which he has directed these proceedings from the opening up till the present moment.

This motion being duly seconded, was carried, amid applause.

THE PRESIDENT: I thank you very much, gentlemen, for your expression of good will, although I do not see that I have done anything particular to deserve it. The task of directing a meeting like this is a pretty easy one, seeing that the members are so willing to be directed.

As there is no other business before us I will now declare the Twelfth Annual Convention of this Society closed.

THE EXHIBITION

For the first time in 1905 an attempt was made to have an exhibition of municipal supplies which should supplement the usual technical meeting. The exhibition was held in the Crystal Rink and a large display was made from many sections of the country. The exhibits were not as well examined as they deserved, as the time of the Convention when not engaged in meeting was given to the matters which had been planned by the local committees. But enough was seen to demonstrate that the effort was a success and that it can easily be made a prominent feature of future meetings, when specific times should be set apart for examining the different exhibits.

The entire matter of future exhibitions has been placed in the hands of a special committee appointed by the President for this purpose.

The following were the exhibitors present:

American Asphaltum & Rubber Co., 721-3 Woman's Temple, Chicago, Ill.	"Pioneer" Mineral Rubber Pipe Coating. "Pioneer" Waterproof Asphalt. "Pioneer" Asphalt Filler. "Pioneer" Paving Asphalt. "Wasatch" Mastic.
William H. Arthur, Stamford, Conn.	Repressed vitrified brick blocks for "T" rails.
C. L. Berger & Sons, 37 Williams St., Boston, Mass.	Precise Engineering and Surveying Instruments.
The Blair Light Co., Northboro, Mass.	Automatic High Candle Power Lamp.
Buff & Buff Mfg. Co., Jamaica Plain Station, Boston, Mass.	Precise Engineering Instruments.
Canadian Fire Hose Co., 14 St. Sacrament St., Montreal, Can.	Underwriter's Fire Extinguishers.
Canadian Fairbanks Co., Ltd., Montreal, Toronto, Vancouver, Winnipeg.	Hydrant, Valves and Waterworks Supplies.

The Construction & Paving Co., Ltd., Toronto, Ontario.	Pavements, Sewerage, Waterworks and General Contractor.
Jules Colas, 6 St. Denis St., Montreal, Can.	New Drainage Well.
Godson Constructing Co., City Hall Square, Toronto, Can.	Railroad, Waterworks and Sewer Construction.
The Goold, Shapeley & Muir Co., Ltd., Brantford, Can.	The "Ideal" Concrete Mixer.
Kolesch & Co., 138 Fulton Street, New York City.	Surveying Instruments.
McAvoy Vitrified Brick Co., German-American Bldg., Philadelphia Works, Perkiomen Junction, Pa.	Shale Paving Brick and Blocks.
The John McDougall Caledonian Iron Works Co., Montreal, Can.	Pumps, Water Wheels, Water Meters, etc.
The Metropolitan Brick Co., Canton, Ohio.	Metropolitan Paving Blocks.
The Montreal Pipe Foundry Co., Ltd., Montreal, Can.	Cast Iron Water Pipes.
The James Morrison Brass Mfg. Co., 85 Adelaide St., West, Toronto, Can.	Brass valves and all kinds of brass goods.
T. A. Morrison, 204 St. James Street, Montreal, Can.	
Municipal Journal Publishing Co., 140 Nassau Street, New York City.	
Neptune Meter Co., 120 Liberty Street, New York City.	Trident Disc and Crest Water Meters, all sizes.
Northern Electric and Mfg. Co., Ltd., 371 Aqueduct St., Montreal, Can.	All kinds of electrical instruments and fire alarm apparatus.
The Ontario Asphalt Block Co., Windsor, Ontario.	Asphalt Paving Blocks.
Pittsburg Filter Mfg. Co., Farmers' Bank Building, Pittsburg, Pa.	Gravity Filters, Pressure Filters, Water Softening Plants.
F. H. Pough, 28 Burling Slip, New York City.	Pozite, pipe joint cement for wet trenches.
The Sawyer & Massey Co., Ltd., Hamilton, Ontario.	Rock Crushers, Road Graders, Steam and Horse Road Rollers and General Road Machinery.
The Sayer Electric Co., 14 Beaver Hall Hill, Montreal, Can.	General Electrical Fixtures.

The Sessions Foundry Co., Bristol, Conn.	Manholes, Sewer Traps and all kinds of Municipal Castings.
Sicily Asphaltum Paving Co., 43 and 45 Prince St., Montreal, Can.	Asphalt and Granite Pavements and Carboron Cold Water Proofing.
The Thomson Meter Co., 83 Washington Street, Brooklyn, N. Y.	Water Meters of all sizes.
Frederick Todd, Montreal, Can.	Landscape Architect.
U. S. Wood Preserving Co., 29 Broadway, New York City.	Creo-resinate Wood Pavements.
Warren Bros. Co., 93 Federal Street, Boston, Mass.	Bitulithic Pavements.
The Waterous Engine Works Co., Ltd., Brantford, Can.	Fire Engine for Cities and Villages.
The Wilkinson Plough Co., Toronto, Can.	Dumping Wagons, Scrapers, Ploughs, Road Planers, etc.
R. D. Wood & Co., 400 Chestnut Street, Philadelphia, Pa.	Constructers of Gas and Water Works. Mathews' Hydrants, Gates, Check Valves, Cast Iron Pipe, Pumping Engines, etc.

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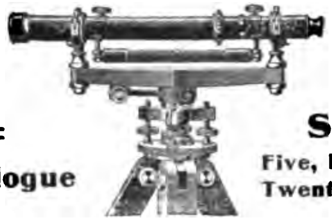

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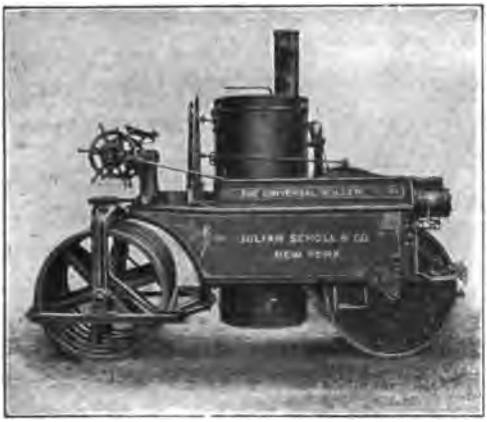

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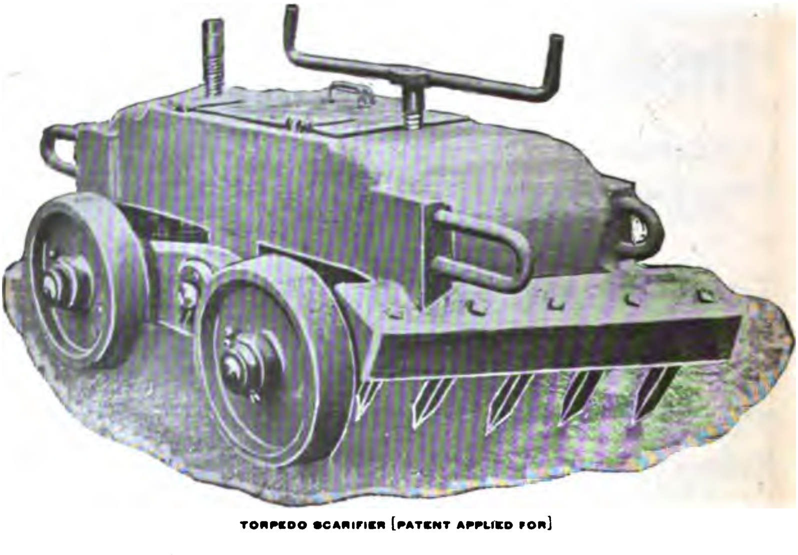

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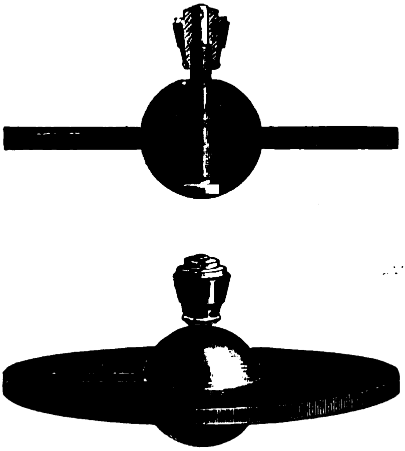

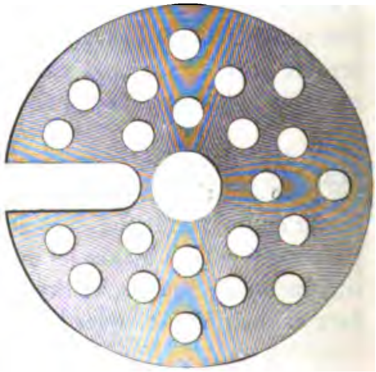

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HELD AT
BIRMINGHAM, ALABAMA

October 9th, 10th, 11th and 12th,
1906

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OF THE

THIRTEENTH ANNUAL CONVENTION

OF THE

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1906-1907

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OF

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CONSTITUTION OF THE SOCIETY

ARTICLE I—NAME AND OBJECT.

Section 1. The objects of this Society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments, and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon Municipal Improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II—MEMBERSHIP.

Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer, or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work.

Any member who shall have ceased to have charge or supervision of any public or municipal department or work may retain his membership, unless he shall have come under the restrictive requirements of associate membership, when he shall retain membership as an associate only.

Sec. 2. Every application for membership shall be in writing, stating the name, location and department, if any; and, if of an individual, shall also state age, residence and position of the applicant, if any.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III—Fees and Dues.

Section 1. Each corporate member shall pay five dollars per annum, and each associate member shall pay ten dollars per annum. All dues to be payable in advance, on or before the date of the annual meeting.

ARTICLE IV—Officers.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of the same state, and who with the Past Presidents who have retained their continuous membership shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following standing committees:

1. Street-Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any liabilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI—DUTIES.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to pre[illegible] a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII—MEETINGS.

Section 1. The annual meeting of the Society shall be held on the second Tuesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII—ORDER OF BUSINESS.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Report of special committees.
9. Reading and discussion of papers.
10. Election of officers.
11. Selection next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX—AMENDMENTS.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vôte of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the 1st day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain, from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

LIST OF MEMBERS

Corporate Members

Ackerman, J. Walter, City Engineer, Auburn, N. Y.
Allen, C. R., Jr., City Engineer, Barre, Vt.
Allin, Thos. D., 72 N. Fair Oaks Ave., Pasadena, Cal.
Alvord, John W., Consulting Engineer, 127 Hartford Bldg., Chicago, Ill.
Anderson, L. W., City Engineer, Grand Rapids, Mich.
Andrews, Horace, 125 Lancaster St., Albany, N. Y.
Arthur, William H., Superintendent of Public Works, Stamford, Conn.

Baker, Henry E., City Engineer, Watertown, N. Y.
Ball, R. W., City Engineer, Henderson, Ky.
Barlow, John R., City Engineer, Montreal, Canada.
Barr, J. Carroll, Economy, Pa.
Barrow, E. S., City Engineer, Hamilton, Ont.
Bauman C. V., Street Committee, Newark, N. J.
Bayles, Howard G., Consulting Engineer, 37 W. 34th St., New York City.
Benzenberg, Geo. H., Consulting Engineer, 436 Jefferson St., Milwaukee, Wis.
Berry, George, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Blair, Bryce R., City Engineer, Carbondale, Pa.
Bock, Frank J., Board of Public Works, Newark, N. J.
Boley, C. U., City Engineer, Sheboygan, Wis.
Bragg, Harry, Editor Canadian Municipal Journal, Montreal, Canada.
Breen, J. E., Chief Engineer, Board of Public Service, Cincinnati, O.
Briggs, B. E., City Engineer, Erie, Pa.
Brown, Charles C., Editor Municipal Engineering, Indianapolis, Ind.
Brown, C. W., City Clerk, Winnipeg, Man.

Cappelen, F. W., 702 Oneida Block, Minneapolis, Minn.
Carpenter, George A., City Engineer, Pawtucket, R. I.
Case, E. W., City Engineer, Colorado Springs, Colo.
Chairman of Municipal Council, St. Johns, Newfoundland.
Chausse, Alcide, Building Inspector, Montreal, Can.
Christy, L. V., Secretary Street and Sewer Dept., Wilmington, Del
Clark, Alfred, Commissioner of Highways, Concord, N. H.
Crandall, Wm. S., Room 420, 253 Broadway, New York City.
Codd, George P., Mayor, Detroit, Mich.
Codwise, Edward B., City Engineer, Kingston, N. Y.

Dalton, E. L., City Engineer, Dallas, Texas.
Dalrymple, F. W., City Engineer, Bayonne, N. J.
Day, William F., Engineer in Charge of Sewers, Detroit, Mich.
Denman, A. R., Board of Public Works, Newark, N. J.
Dow, A. W., Consulting Chemist, 120 E. 23d St., New York City.

Earle, Geo. G., Gen'l Supt. Sewerage and Water Board, New Orleans, La.
Easby, Wm. Jr., Asst. Professor of Civil Engineering, College Hall, University of Pennsylvania, Phildelphia, Pa.
Eggers, Augustus F., Board of Works, Newark, N. J.

Fisher, E. A., City Engineer, Rochester, N. Y.
Floyd, William H., Jr., City Engineer, St. Joseph, Mo.
Folwell, A. Prescott, Consulting Engineer, Easton, Pa.
Fort, E. J., Assistant Engineer, Bureau of Sewers, Borough of Brooklyn, N. Y.
Fortune, Wm., Publisher Municipal Engineering, Indianapolis, Ind.
Freiberg, M. J., Waterworks Commission, 216 E. Front St., Cincinnati, O.
Freshney, S. A., Secretary and General Manager, Board of Public Works, Grand Rapids, Mich.
Fuller, George W., Consulting Engineer, 170 Broadway, New York City.

Gainey, W. H., City Engineer, Valdosta, Ga.
Giddings, Fred, City Engineer, Atchison, Kan.
Gilchrist, Allen R., City Engineer, Montgomery, Ala.
Glore, W. H., Superintendent Waterworks, Covington, Ky.
Goodell John M., Editor Engineering Record, 114 Liberty St., New York.
Greathead, Wm. E., Clerk Board of Public Works, Newark, N. J.
Griffith, John E., Assistant Engineer, Dep't of Water Supply, Borough of Brooklyn, N. Y.
Griggs, Julian, Scioto Valley Traction Co., Columbus, O.
Grosser, Hugo S., City Statistician, 207 City Hall, Chicago, Ill.

Hamell, J. M., City Engineer, Hull, Que.
Harper, E. A., City Engineer, Kansas City, Mo.
Hatton, T. Chalkly, Engineer Street and Sewer Dept., Wilmington, Del.
Hazelhurst, J. N., Engineer Board of Public Works, Mobile, Ala.
Henry, P. W., Consulting Engineer, 17 Battery Place., New York City.
Herrman, August, President Waterworks Commissioners, Cincinnati, O.
Hinds, Frank A., Consulting Engineer, Watertown, N. Y.
Holloway, C. M., Waterworks Commissioner, Cincinnati, O.
Howard, J. W., Consulting Engineer, No. 1 Broadway, New York, N. Y.
Howe, W. B., City Engineer, Concord, N. H.

Johnson, Edward J., City Engineer, Nashua, N. H.
Johnston, A. L., Sewer Department, Wilmington, Del.
Jones, John, Superintendent of Streets, Toronto, Ont
Judson, William Pierson, Broadalpin, Fulton Co., N. Y.

Kay, Prof. Edward B., University of Alabama, Tuscaloosa, Ala.
Kendrick, Julian, City Engineer, Birmingham, Ala.
Ker, N. I., City Engineer, Ottawa, Can.
Kummer, F. J., General Manager U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Leisen, Theo. A., Wilmington, Del.
Leonard, C. E., City Engineer, Austin, Texas.
Lewis, N. P., Chief Engineer Board of Estimate and Apportionment, New York City.
Ludlow, J. L., Consulting Engineer, Winston-Salem, N. C.
Luster, W. H., City Surveyor, Elizabeth, N. J.

McCartin, J. M., Street Commissioner, Birmingham, Ala.
McClintock, John N., Consulting Engineer, 45 Milk St., Boston, Mass.
McCormick, R. H., City Engineer, Detroit, Mich.
McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.
McMillan, Chas., City Clerk, Calgary, Canada.
Magley, Wm., Board of Public Service, Cincinnati, O.
Markbreit, L., Waterworks Commission, Cincinnati, O.
Mead, D. W., 605 First National Bank Bldg., Chicago, Ill.
Meade, R. E., Consulting Engineer, 1520 Brown-Marx Building, Birmingham, Ala.
Melvin, T. H., Sewer Dept., Wilmington, Del.
Minshall, Frederick, Consulting Engineer, Abbeville, S. C.
Mitchell, J. K., Asst. City Engineer in Charge of Sewers. Detroit, Mich.
Monie, John M., Municipal Engineer, Bonne Terre, Mo.
Murphy, F. E., Supt. of Streets and Waterworks, Huntsville, Ala.

Nelson, John A., City Engineer, Mitchell, S. D.
Neville, Thos., Deputy Commissioner of Public Works, Rochester, N. Y.

O'Brien, F. J., 112 W. Bridge St., Oswego, N. Y.
Owen, Jas., Consulting Engineer, 196 Market St., Newark, N. J.

Parent, Arthur, Supt. City Lighting Dept., Montreal, Canada.
Parker, G. A., Superintendent Keney Park, Hartford, Conn.
Parkes, William J., City Engineer, Pine Bluff, Ark.
Phillips, Geo., Board of Public Works, Newark, N. J.
Phinney, F. J.,. Superintendent Water Works, Rockford, Ill.
Pollock, Clarence D., Assistant Engineer Bureau of Highways, Brooklyn, N. Y.
Potter, W. G., City Engineer, Greensboro, N. C.
Provost, A. J., Jr., 518 Fifth Ave., New York.
Provost, Peter, Chief Fire Dept., Ottawa, Canada.

Rankine, E. S., Engineer Sewer Department, Newark, N. J.
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Reichardt, Walter F., Assistant City Engineer, Little Rock, Ark.
Reimer, W. H. V., City Engineer, East Orange, N. J.
Reiter, George W., City Engineer, Salt Lake City, Utah.
Rommel, Geo., Jr., Engineer Street and Sewer Dept., Wilmington, Del.
Rust, Chas. H., City Engineer, Toronto, Ont.
Ruttan, H. N., City Engineer, Winnipeg, Manitoba.

Sanderson, H., Alderman, Winnipeg, Man.
Schmidt, Jacob, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Sheridan, John C., Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.
Sherrerd, M. R., Superintendent Waterworks, Newark, N. J.
Shipman, Charles M., Gen'l Supt. of Works, Newark, N. J.
Smith, Wright, Chief Engineer, Board of Public Works, Mobile, Ala.
Solotaroff, William, Supt. Shade Tree Commission, East Orange, N. J.
Strachan, Joseph, Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.
Stewart, Wm. J., First Assistant City Engineer, Rochester, N. Y.
Stobaeus, J. B., 160 Clifford St., Newark, N. J.

Talbot, A. N., Professor of Civil Engineering, University of Illinois, Urbana, Ill.
Taubenheim, Ulrich E., Manager City Waterworks, Archangel, Russia.
Thompson, A. D., 304 Masonic Temple, Peoria, Ill.
Thompson, S. C., Prin. Asst. Engineer Bureau of Highways, Borough of Bronx, New York.
Tillson, Geo. W., Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Todd, Fred. G., Landscape Architect, Montreal, Canada.

Vinson, J. S., Board of Public Works, Newark, N. J.
Vrooman, Morrell, City Engineer, Gloversville, N. Y.

Watson, George S., 54 Baxter Building, Philadelphia, Pa.
Wheeler, Holland, City Engineer, Lawrence, Kan.
Whipple, George C., Consulting Engineer and Sanitary Expert, 220 Broadway, N. Y.
Weissleder, L. H., Consulting Engineer, with the Cincinnati and Suburban Bell Telephone Co., Cincinnati, Ohio.
Wilmot, H. W., Expert Accountant, 54 William St., New York City.
Wilson, W. M. City Engineer, Gadsden, Ala.
Wingfield, Nisbet, City Engineer and Com. of Public Works, Augusta, Ga.
Wright, Francis H., City Engineer, Helena, Ark.

Associate Members

A. L. Barber Asphalt Co., 17 Battery Place, New York City.
Adler, Arthur A., 804 Chamber of Commerce, Chicago, Ill.

Bangham, Richard, Ontario Asphalt Block Co., Windsor, Ont.
Barrett, Manufacturing Co., 17 Battery Place, New York City.
Beck, H. N., Mgr. Canada Fire Hose Co., 14 St. Sacrament St., Montreal, Canada.
Blair, F. N., President Blair Light Co., Northboro, Mass.
Buff, Lewis F., Asst. Treas. Buff & Buff Mfg. Co., Jamaica Plains, Boston, Mass.
Buffalo Steam Roller Co., Buffalo, N. Y.

Cameron, Hugh, Agent Waterous Engine Co., 72 Queen St. W., Toronto, Canada.
Clements, L. L., U. S. Wood Preserving Co., Mercantile Library Bldg., Cincinnati, Ohio.
Coburn, H. P., General Manager, Sawyer & Massey Co., Hamilton, Ont.
Cochrane, D. J., Sicily Asphaltum Paving Co., Montreal, Canada.
Colas, Jules, Mfr. of steel gullies, 6 St. Denis St., Montreal Canada.

Davis, Robert K., Hammond Bldg., Detroit, Mich.
Decarie, F. L., Chief Engineer, Decarie Mfg. Co., Minneapolis, Minn.
Dill, Charles W., Manager Constructing & Paving Co., Toronto, Ont.
Donaldson, John, Southern Bitulithic Paving Co., Birmingham, Ala.
Drummond, T. J., President Montreal Pipe Foundry Company, Vice-President Montreal Water & Power Co., Montreal, Canada.

Ellis, Geo. V., President Ellis Company, 216 W. 23rd St., New York City, N. Y.
Engstfeld, G. C., Southern Paving & Construction Co., Birmingham, Ala.

Folger, M., President, Thompson Meter Co., Brooklyn, N. Y.
Folkes, E. C. E., Manager Wilkinson Plough Co., Toronto, Can.
Fuller, H. J., President, Canadian Fairbanks Co., Montreal, Can.

Hutchinson, F. S., 17 Battery Place, New York City.

Ingram, G. M., 81 N. Cherry Street, Nashville, Tenn.
Irwin, A. B., Sec. and Treas. Pacific Coast Pipe Company, 1551 Granville Street, Vancouver, B. C.

Lasley, T. H., Vice-President Southern Clay Mfg. Co., Chattanooga, Tenn.
Lasley, W. M., President Southern Clay Mfg. Co., Chattanooga, Tenn.

McEvoy, John G., Secretary and General Manager McEvoy Vit. Brick Co., 1345 Arch Street, Philadelphia, Pa.
Martin Harry K., Fire Appliances; Street Railway Chambers, Montreal, Can.
Mead, A. J., Reinforced Concrete Pipe Co., Jackson, Mich.
Morrison, James, President James Morrison Brass Mfg. Co., Toronto, Ont.

Morrison, T. A., 204 St. James St., Montreal, Can.
Mussen, W. H. C., 299 St. James Street, Montreal, Can.

Parker, R. H., Southern Clay Mfg. Co., Chattanooga, Tenn.
Pittsburg Filter Company, Pittsburg, Pa.
Pough, F. H., Sewer Cement Manufacturer, 28 Burling Slip, New York City.

Reinforced Concrete Pipe Co., Jackson, Mich.
Rock, J. C., 17 Battery Place, New York City.
Root, John M., General Manager Decarie Manfg. Co., Minneapolis, Minn.

Scholl, Julian, 126 Liberty Street, New York, N. Y.
Southern Cement Co., Birmingham, Ala.
Strain, Jas. H., Road Rollers and Road Machinery, 254 East Twenty-first St., Brooklyn, N. Y.

Tenney, George O., President Atlantic Bitulithic Paving Co., Spartanburg, S. C.
Trudel, Tancrede, 107 Bleury Street, Montreal, Can.

Warren, Geo. C., 93 Federal Street, Boston, Mass.
Warren, Ralph, 93 Federal St., Boston, Mass.
Wertz, J. L., Vice President Neptune Meter Co., 120 Liberty Street, New York, N. Y.
White, W. W., Reinforced Concrete Pipe Co., Jackson, Mich.
Wilson, John A., 902 First National Bank Bldg, Nashville, Tenn.
Wood, R. D. & Company, Waterworks Supplies, 400 Chestnut St., Philadelphia, Pa.
Wunder, F. A., Iroquois Iron Works, Buffalo, N. Y.
Wyllie, H. D., General Manager Cameron Septic Tank Co., 812 Monadnock Block, Chicago, Ill.

NEW YORK, October 17th, 1905.

Mr. Geo. W. Tillson, Sec'y American Society of Municipal Improvements,
Room 12, Municipal Bldg., Brooklyn, N. Y.

DEAR SIR: It is the hope of the Board of Directors of the American Society of Civil Engineers that its cordial relations with other associations of engineers be maintained and if possible strengthened.

I am therefore directed to say that the Society will always be glad to receive visits from your members; that its Reading Room and Library are open to them; and that their presence at any of its professional meetings (which are held at 8:30 P. M. on the first and third Wednesdays of each month, with the exception of July and August) will be most heartily welcome.

Trusting that you will inform the membership of your Society that this is the case, and that we shall have the pleasure of receiving such of them as may find it convenient when in New York, I am

Yours faithfully,
CHAS. WARREN HUNT,
Secretary.

THIRTEENTH ANNUAL CONVENTION

OF THE

American Society of Municipal Improvements

THE PRESIDENT: The Convention will now come to order. I have the pleasure of introducing to you Mr. Henry Gray, who is the the Lieutenant Governor-elect of the State of Alabama, who will welcome us to the city and the state. (Applause.)

MR. HENRY GRAY: Mr. Chairman, Ladies and Gentlemen: I trust that when I appear here in the position of a substitute for our distinguished Mayor, Mr. George Ward, who had business out of the city today, that you will not think your welcome to Birmingham is less cordial or less hearty than if he had extended it himself.

During the past year, or during the present year, it has been the pleasure of Birmingham to have within its midst a great many distinguished bodies. First we had the Medical Society of the State of Alabama. Then we had the conference of the Methodist Churches of the United States, with some thirty or forty distinguished bishops; and then we have had since that time the teachers of the State of Alabama. But, I do not believe that during the year we have had a body whose aim and whose object is worth more to the people of this city and of this state, and of the cities that they represent, and from which they came, than the distinguished body which presents itself to us today. (Applause.)

Birmingham is a new town, and started within the memory of a great many of you who are present here today, and it owes a great deal to the distinguished engineer, a man who I know it is your pleasure, as well as ours, to honor, Col. Geo. E. Waring, Jr., formerly of New York, who laid out the system of sewerage for this city. Coming as you do, a great majority from distant states, you probably are not familiar with our community or our state. Alabama first in the sisterhood of states, is first in almost everything. I certainly feel that we are first in our welcome to all of you who are here today, and I trust that your visit here will be fraught with interest and benefit to you as well as of interest and benefit to ourselves. What we are doing I believe is along the line of municipal improvements, so far as the City of Birmingham is concerned. We are attempting to build a city that will in the future reflect credit upon those of us who are gone and who left matters easy for those who are to follow. I trust that your visit here will be of benefit to you, and that it will be of interest to you, and that it will be of benefit and interest to our good people.

I want to say that the keys of the City of Birmingham are now turned over to you, and if you should happen to get locked up, we will endeavor to have the keys taken by some one and have you unlocked. (Applause.)

THE PRESIDENT: Gentlemen, we have the honor and pleasure of now listening to Mr. J. L. Parker, who represents the Commercial Club, of Birmingham (Applause.)

MR. CHAIRMAN, LADIES AND GENTLEMEN: It is a very bad thing at least to be last. The proper thing for me to have done would have been to explain to you and to have told you who the distinguished gentleman was who has just addressed you. He is evidently not a stranger to us, and he is not a stranger to the greater part of the United States. We are proud of him ourselves, for he has done a great deal to help develop this great district of ours. We are a young city, and we have a still younger district, and this district has been developed by young men, men who are not babies in intellect or energy. The whole commercial interests of Birmingham depend upon the development, not only of the city, but the entire community, and on behalf of the club that I represent, the Commercial Club, I welcome you to Birmingham, and to the advantages of our club; and I hope that you will leave us feeling that you have not only had a good time, but that you will see something and will tell to the world the wonderful things that you see and what we propose to show you throughout this district. (Applause.)

THE PRESIDENT: I do not know that there is very much that I can say, except to thank the gentlemen for the hospitality which they have so cordially offered us, and also to thank the local committee for the excellent program which they have prepared in the way of showing us what Birmingham is like.

I have been traveling back and forth across the South for a few days on my way here, and I must say that I have been very much impressed with the resources which this country has. It is really the first time I have ever had the opportunity to find out what there is here We have the history of it, which came to us in the North, but it is very much better for us to see it, and even in the short time it takes us to come here, we can see that you have great things in store. I have been in several cities on the way, both Northern and Southern cities, and I must say that Birmingham is a handsome city, the handsomest I have seen in the South. I believe we will have a good time while we are here, and I believe we will see some things which will be of great interest to us, and we will leave here with a great addition to our store of knowledge, and we will try to reciprocate in the best way we can, in our good conduct while we are here, and the papers and discussions which we will try to offer. (Applause.)

THE PRESIDENT: We will now proceed with the regular order of business. I believe it is customary to dispense with the roll call and the reading of the minutes of the last meeting. And the consideration of membership will also be postponed until a later day, because new members are coming in, and they are not all here yet. The next order of business, I believe, is the President's address.

PRESIDENT'S ADDRESS.

The President's address in a society of this sort is very frequently a perfunctory review of the progress of the year, or in some branch of the work covered by the society. With us this duty is very much better performed by the Committee on Review, which spends a year getting its information together, and has two or three engaged upon its report. The achievements of the Society itself, the history of its efforts, have been quite fully set forth in several Presidents' addresses and papers before this and other societies, one of which I had the honor to prepare for the civic week at the St. Louis Exposition. An address on this subject would also be guilty of repetition of material already familiar to us all. The future of the Society is a subject which has not been over-elaborated, and is one that may be made fresh as it is largely a matter of imagination. While there may be many differences of statements of our past history, which are largely due to our imaginations, these statements have a common basis and cannot get far from it in form at least.

Our ideas regarding the future have only one point in common, the starting point, the condition of the Society at the present time. Papers on the future of the Society depend for their interest upon the quality of the product of the author's imagination. While I cannot hope to give you anything of absorbing interest, there is a subject in which I am personally much interested and in which I would like to interest you if I could. It has already been presented in part to some of the Society, and in papers before other societies, but thus far, with but little result. I will make my statement of it as brief as possible. First, the starting point must be fixed, the present condition of the Society and its tendencies.

Beginning with the administration of the municipal departments to which the construction and operation of public works are entrusted, the Society has emphasized this selection of a field for its activities, and while retaining in its membership the mayors, members of boards and councilmen who are the business heads of the departments, its papers and discussions have been largely in the hands of the technical experts, having the design and construction of works in their charge.

This has been desired by the heads of the departments and the engineers have done the work in the Society which has thus been assigned to them, with pleasure and profit to themselves and others within and without the Society. The published volumes of proceedings which the report of the present convention will make the twelfth and the best collections of papers, data, and discussions on municipal improvement questions which can be found anywhere. These volumes show from year to year the advancement which has been made in methods, materials and results and have usually been slightly in advance of the procession. The good new things have been recognized by the acknowledged experts among the members, and their announcement or indorsement of these improvements has led to their adoption by other cities.

The benefits of the Society have been restricted too much to its own membership. Progressive municipal officers have recognized the value of membership in the Society, and many have been induced to join on account of the valuable character of the proceedings. It is the fact, however, that the knowledge of the value of the Society is not widespread, that many officials do not know of its existence, that many others know it only by name, and that a goodly number of those who see what the value of such a Society might be have taken the trouble to find out whether the Society fills the bill. Some city officials, as well as newspaper men, call the trip to the convention a junket, knowing that many such trips may be so classified, but not knowing the difference in the qualities of societies and their memberships. But there is a still larger number of people who need to know what this Society can tell them but are not eligible to membership because they cannot reciprocate in kind for the benefit they may receive.

Some of these persons selected from our best citizens, the most progressive and public spirited have formed themselves into a society for the study of municipal problems and are doing careful and often most valuable work upon them. They need the information about principles and methods in many lines which the discussions in the Society would give them. They need to feel the spirit that pervades this Society, which they cannot get from reading its proceedings. They must be present and participate in its deliberations to be able to appreciate its character and the aspirations of its members.

But few of the members of the societies referred to are interested in subjects enough to lead them to attend our convention, as at present fixed in time and place, even if they did not feel that they were intruding, since they cannot become members. But they feel the lack of what they know we can give them. More, than this, they recognize that we are working for the same end as themselves—the improvement of municipalities—and recognize what we should recognize also, the co-operation in the good work we are attempting to perform will hasten its successful attainment. It is not surprising, therefore, that they have made overtures for some sort of a combination or correlation.

At our Rochester convention a proposition was made to combine the half dozen or so societies, which, by certain combinations, had been reduced to four, our own Society, the League of American Municipalities, The American Civic Association, The National Municipal League. This proposition, I believe, did not get beyond the Board of Directors, because it seemed to be the unanimous opinion of the members of that body that such a combination would not be advantageous to any of the societies, and certainly not to our own. I made the suggestion at that time that a closer relation, such as that existing between the Association for the Advancement of Science and its affiliated societies might be accepted and this was elaborated on later and an alternative offered if even this bond were irksome. This substitute provided that only the various societies should have the same place of meeting and the times should be chosen so as to be convenient for those who wished to attend more than one convention, all meetings possibly, during the same week, but beginning and ending on different days. The proposition met with some favor, and I have in my hands letters from the American Civic Association and the National Municipal League, asking what can be done towards fixing a common place of meeting of the two societies and our own. I say nothing of the fourth society, because nothing has been heard from them, and the lack of co-operation between that society and our own, when they met during the same week in St. Louis, and East St. Louis, makes it seem improbable that this Society would care to join this movement at this time.

I am fully aware that this Society took little or no interest as a body in the success of the civic week which was held in St. Louis during the same week that our convention was held there, under the auspices of the National Municipal League and American Civic League, but that no interest was manifested at that time is no reason why interest should not be shown now, and it is the purpose of this paper to make another attempt to arouse such interest. There are none of the objections to this proposition which were advanced with reference to that brought up at Rochester. There can be no interference to the work of the organization of this Society. We have an opportunity to extend the influence of our Society without effort on our part aside from that of the committee having charge of the adjustment of time and place. If we are not so wrapped up in ourselves that we can see no one else whom we can aid we can hardly afford to refuse this opportunity. And this does not take into account the benefit which many of us can derive from the other societies and "all for one price of admission."

I might elaborate upon the subject still further, but will refrain, and only ask, What shall we do about it? My own suggestion would be that when the time and place of meeting are voted upon, instructions be given the Board of Directors to take up the matter with the two societies making overtures that they be given the power to make such changes in time and place as may be found necessary.

THE PRESIDENT: I believe the next order of business is the reading of the report of the Secretary.

REPORT OF THE SECRETARY.

BROOKLYN, N. Y., October 1, 1906.

American Society of Municipal Improvements:

GENTLEMEN: I herewith submit my report for the year ending Sept. 30, 1906:

Receipts—	
Dues	$835.25
Sale of Reports	42.50
Advertisements	236.65
Cash in hands of Secretary, Sept. 5, 1905	6.00
Total	$1,120.40

Paid to Treasurer—	
1905.	
September 7	$542.00
November 13	35.00
December 13	75.00
1906.	
January 9	50.25
February 26	41.00
May 1	73.50
May 23	91.00
August 1	58.65
August 17	61.00
September 7	38.75
September 29	44.50
Cash on hand	9.75
Total	$1,120.40

The expenses of the office for the year have been:

Montreal Convention Expenses	$7.00
Freight and Express	12.00
Postage	16.44

Printing	13.75
Sundries	4.65
Total	$53.84

The regular routine work of the office, and the correspondence has been attended to as required.

The following changes in membership have occurred during the year:

Elected September 5th		87
Dropped for non-payment of dues	14	
Resigned	6	
Died	1	—21
Net increase		66

Making the present membership of the Society 170, of whom 122 are corporate, and 48 associate members.

The member who died was Mr. George M. Ballard, of Newark, N. J. He was President of the Society in 1904, and died December 5, 1905.

The Secretary herewith expresses his thanks to all the officials of the Society for their hearty co-operation during the year.

Respectfully submitted,
GEO. W. TILLSON,
Secretary.

(Correct.)
AUGUSTUS F. EGGERS,
FRED GIDDINGS,
Finance Committee.

THE PRESIDENT: Gentlemen, you have heard the report of the Secretary read, what will the convention do with the report of the Secretary?

It was moved by Mr. Hatton, and duly seconded, that the report be accepted and spread upon the minutes of the convention.

THE PRESIDENT: The next order of business, I believe, is the report of the Treasurer. The Treasurer, I understand, is unable to be here, and has sent his report by mail, and it is expected in the morning, and that will have to be postponed until it reaches us.

THE PRESIDENT: There is no report of the Executive Committee, and the report of the Finance Committee will have to be postponed until after the Treasurer's report is received.

THE PRESIDENT: The list of papers will now be taken up as given in the program, on page 46. The report of the Committee on Exhibits will also be postponed until this evening, at which time Mr. Davis will have some interesting announcements to make

I have a letter from Mr. Grosser, or rather his assistant, on the Committee of Statistics, dated October 4, 1906, which I will read:

Mr. Chas. C. Brown, Editor Municipal Engineering, Indianapolis, Ind.:

DEAR SIR: Mr. Grosser has requested me to write to you in answer to your letter of October the 2d. Mr. Grosser is sick at home, and has not been in the office this week, presumably the effect of overwork in connection with the convention of the League of American Municipalities. It is very improbable that Mr. Grosser will attend the convention at Birmingham under the circumstances. He has as yet not prepared the committee report, but hopes to recuperate sufficiently to do so in time for the convention.

Very respectfully yours,
FREDERICK REX,
Assistant City Statistician.

THE PRESIDENT: The next is the report of the Committee on Fire Protection.

THE SECRETARY: Mr. Chausse is not present, and I have his report, but it is a very long paper, and I think it would be well that it be incorporated in the minutes within being read.

THE PRESIDENT: I think this would be the best way to take care of the report. The paper or report of his committee is one on "Standard Threads for Fire Hose and Hydrant Couplings."

REPORT OF THE COMMITTEE ON FIRE PROTECTION.

MONTREAL, CAN., September 15, 1906.

MR. PRESIDENT AND GENTLEMEN: Your Committee on Fire Protection has to report that the question of "Standard Hose Couplings and Hydrant Fittings for Public Fire Service" having already been gone through by the National Fire Protection Association, of which the report is attached to this communication, together with two letters from Mr. F. W. Griswold, on the same subject, suggest that these communications be considered as forming part of this committee's report and entered in the proceedings of this convention.

ALCIDE CHAUSSE,
Chairman Committee on Fire Protection.

NATIONAL FIRE PROTECTION ASSOCIATION.

COMMITTEE ON HOSE COUPLINGS.

RICHMOND, VA., August 30, 1906.

M. Alcide Chausse, Building Inspector, Montreal, Can.:

MY DEAR SIR: I am advised by Mr. George W. Tillson, Secretary of the American Society of Municipal Improvements, that you are the chairman of its Committee on Fire Protection, and I beg now to address you upon a subject which appears to me of the utmost importance for the consideration of an association such as yours, and in this, I refer to the matter of standardizing hose and hydrant couplings for public fire service, and it seems to me that amongst all utilities coming under the control of municipal authorities there is none which has had less deserved attention than this very important one; and it therefore seems to me that it is almost unnecessary to more than call your attention to the conditions as they exist.

I question whether I can make more plain to you the position in which the association represented by myself stands in regard to this matter, than by enclosing herewith a carbon copy of a letter on this subject written to your Mr. Tillson some days ago and by supplementing same with a copy of our association's circular, descriptive and illustrative of the national standard hydrant and hose couplings, which I trust, my dear sir, may have your careful thought and consideration, in the hope that through your very valuable co-operation the day may be hastened when any community may be enabled to render aid to its neighbors when called upon in time of emergency with an assurance that such well-intended effort to assist will meet with success, where under present experience the efforts of outside organizations to render aid to neighboring communities has generrally proven futile, from the lack of harmony in the devices and utilities in use, the principal trouble arising on account of variations in hydrant and hose thread couplings.

Extending my apologies for approaching you in this matter without a more intimate acquaintance than that suggested by the Secretary of your Association, I trust that my plea in behalf of securing your earnest cooperation in the matter under consideration may be none the less successful, and that it may be my pleasure to hear from you at your convenience in expression of your opinion in regard to this very important matter, in anticipation of which, I beg to be, my dear sir,

Yours very truly,
F. M. GRISWOLD,
Chairman.

NATIONAL FIRE PROTECTION ASSOCIATION.

NEW YORK, August 14, 1906.

American Society for Municipal Improvement, Municipal Building, Brooklyn, N. Y., Mr. Geo. W. Tillson, Secretary:

DEAR SIR: Noticing the published announcement of the Annual Convention of your Association, to be held at Birmingham, Ala., during October, 1906, I am moved to address you in relation to a subject of such wide importance to all municipalities as to warrant the assumption that action upon it in approval simply awaits its introduction to the attention of your honorable body, and in explanation of this assumption, beg to submit for your information and consideration the enclosed circular illustrative and descriptive of the "National Standard" hose and hydrant coupling, which has been adopted by all of the prominent organizations and associations having charge and control of fire department appliances and utilities throughout the country.

In presenting this matter for consideration of your Association, it is desired to make plain the fact that we are moved by no other incentive than the conservation of the public welfare in the line of protection against loss of life and property through fires and conflagrations which may pass beyond control of any local organization, and which therefore necessitate calls for assistance from neighboring cities or communities in the time of peril, as has been so frequently demonstrated in the sweeping fire in various cities of the country during the past two or three years.

It is needless, perhaps, to remind any member of your Association of the fact that in many instances of conflagration it has been found impossible to utilize the apparatus of such outside organizations as may respond for the call for help, however willingly such service may have been tendered, and this simply from the fact that the appliances of such apparatus as comes to aid, do not interchange with those in use by the department seeking assistance, and that practically all of such troubles are to be found in the lack of uniformity in hose and hydrant couplings.

Hence, it appears to this committee that no more urgently important matter could be brought before your Association than that of the endorsement and approval of the standard hose and hydrant couplings and their adoption, to the end that by such uniformity it becomes possible for each municipality or community to be assured of efficient aid from its neighbor when necessity demands calling for its assistance to check the spread of a disastrous fire. We, therefore, appeal to your Association to give this matter its most careful consideration, expressing the hope that its action may afford added proof of that broad comprehension and wise judgment which seeks the accomplishment of the betterment of conditions in relation to the safety of life and property throughout the country, and that to this end your honorable Association may endorse and approve this very essential element of municipal control and utility.

It will afford us much pleasure to send you such number of copies of the enclosed circular as you may desire, and in anticipation of hearing from you at an early date, we beg to be,

Yours very truly,
F. M. GRISWOLD,
Chairman.

STANDARD THREAD FOR FIRE HOSE AND HYDRANT COUPLINGS,

ADOPTED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS, AS RECOMMENDED BY THE NATIONAL FIRE PROTECTION ASSOCIATION.

GENTLEMEN: Realizing the vast and imperative importance to the welfare and prosperity of the country which will result from the speedy adoption and installation of standard hose and hydrant couplings in every community where a fire department with a water supply is in service, this committee takes much pleasure in presenting for your information and consideration the following details of specification together with full size drawings of the established standard for hose and hydrant couplings, as adopted by the leading waterworks and firemen's associations and other national bodies, as nominated on another page.

The ends sought in presenting this matter to you somewhat in detail are two-fold in purpose, first to recall to your minds the halting and inconclusive efforts of past attempts to secure the adoption of a universal threaded coupling and the disastrous results which have supervened in many communities on account of the lack of harmony in such public utilities, and second, to express the hope in having this record before you, supplemented by the special conditions which have prompted us to nominate and advocate the adoption of the particular standard herewith presented, that we may secure your most hearty, earnest and persistent effort to a speedy and final settlement of this very important matter by the adoption of the standard suggested within the territory under your control or influence.

While we fully appreciate the fact that it depends upon the co-operation of the various water-works and fire department organizations to insure the acceptance of any standard involving a change from present practice, we have such an abiding faith in the sound judgment and well grounded public spirit of the members of the various organizations having interest as to feel assured that co-operation in the present attempt is sure to be had after mature consideration of the matter herewith presented.

In the following brief resume of the history of the effort to secure the standardization of hose and hydrant couplings, it appears from the available records that the International Association of Fire Engineers is to be credited with the first organized attempt to secure that result through the action of a special committee, of the then "National" association which in

1873, at Cleveland, Ohio, recommended a universal thread of 7½ to the inch on 2½ inch fire hose coupling, which some departments adopted, and also suggested the use of reducers and expanders as a measure of economy.

1876, suggested that the standard of New York be adopted, no details being recorded, but report was "laid on the table."

1878, there was submitted a proposition to adopt 8 threads to the inch, with an inside diameter of 2½ inch and outside diameter of 3⅛ inch "the use of which was found impracticable" by committee and action by Congress, with penalties, proposed.

1879, a "National Standard" was adopted, being 3 7-32 inch outside diameter, 2½ inch inside diameter with 6 threads to the inch, "V" shaped and slightly flattened at the top. (An unverified record shows this to have been 3 13-64 inch by 2½ inch, with 6 threads flat in shape.)

1883, the convention proposed memoralizing state governments to take action for the adoption of the 1879 thread as a standard.

1890, Mr. C. A. Landy, then representing the Fabric Fire Hose Company, urged the adoption of a standard hose thread coupling, but no particulars of dimensions are recorded.

1891, this same Mr. Landy presented a very complete, intelligent and interesting paper on the subject, in which was advocated the adoption as the standard, a coupling of 3 1-16 inch outside diameter, 2½ inch inside diameter, with 7½ threads to the inch, "V" shaped, which proposition was adopted by the Association on Committee report.

This report of 1891 completes the sporadic action taken by the firemen's association in attempts to seek a common ground upon which to harmonize the existing differences in this most important of public utilities, and the subject remained practically dormant until the fall of 1904, when a committee was selected by the International Association of Fire Engineers to give the matter further consideration in conjunction with a similar committee selected by the National Fire Protection Association, this joint action being stimulated to accomplishment through the disastrous conflagrations which had but recently swept the cities of Baltimore, Rochester and Toronto, where in each instance had been so plainly demonstrated the inability of visiting fire apparatus to render efficient service, owing to the fact that no two cities or towns were equipped with apparatus of like gage as to diameters or number of threads to the inch on hose or hydrant couplings and practically all efforts to help in these times of dire emergency were therefore rendered nugatory. Added to the practical lessons burned into the mind by the conflagrations above noted, was the knowledge that there are dozens, if not hundreds, of other cities liable to be swept by conflagrations of equal severity and under the same conditions of practical isolation from outside assistance, which prompted this committee to enter upon the task set before it with energy and a determination to arouse public opinion, as well as that of the bodies interested in or responsible for the maintenance of fire apparatus and utilities to the crying evil of present conditions of diversity in the make-up of these essentials to efficient fire fighting.

It affords this Committee therefore much pleasure to record the fact that from the initiative it has been accorded the most cordial and hearty support in its efforts, with the result that the standard as nominated by it has now received unqualified and practically unanimous approval and adoption by the following associations and organizations, by vote at their recent annual convention, as noted:

The American Waterworks Association, West Baden, Ind., May 9, 1905.

International Association of Fire Engineers, Duluth, Aug. 19. 1905.
National Firemen's Association, Kansas City, Mo., Aug. 30, 1905.
New England Waterworks Association, New York, Sept. 14, 1905.
Pennsylvania Waterworks Association, Atlantic City, 1905.
North Carolina Firemen's State Association, August, 1905.
National Board of Fire Underwriters, May 23, 1905.
National Fire Protection Association, May 23, 1905.

To the above might be added the names and titles of various district and state organizations, subsidiary to the above, which have recorded approval of the standard herein nominated, and it will therefore be seen that the matter is now well under way for universal adoption, and it is encouraging to be able to state that one of the most important cities in the country, namely, St. Louis, Mo., has already adopted this standard, changing from six threads to the inch to seven and a half to the inch on all hose couplings and other connections.

While it is not to be assumed that all couplings and attachments for fire service which now differ from the established standard can or will be immediately discarded for that, it is impossible to make the substitution gradual, easy and inexpensive by the use of adapters at all hose and hydrant couplings until the fixed connections on the established standard gage may be made permanent on the plant already installed, while on new hydrants and hose, standard gage should be specified as an essential to acceptance. We are reliably advised that adapters cut to the established standard gage on one side and on the other side to the present gage in use in any department, may be had at a cost of $1.00 each, and can be used for either hydrant or hose couplings.

Another point in the matter of economy of substitution is to be found in the fact that all couplings having seven, seven and a half or eight threads to the inch, with diameters ranging from 3 1-16 inch to 3⅛ inch to the outside of the male thread, may be made serviceably operative with a standard female coupling of seven and one half threads to the inch, by cutting down the excess diameter as the case may require, and this without seriously impairing the strength and efficiency of the coupling. Reliable data, upon which is based the nomination of the established thread, show that the standard 7½ thread female or swivel coupling will accommodate about 70 per cent of the couplings now in use in this country under the conditions as above indicated.

In the following tables will be found full specifications for the various dimensions and parts of the several standard couplings as now established, which when read in connection with the full sized drawings also attached, should make plain the fullest details needed for their construction, and we trust they may serve that purpose.

NATIONAL FIRE PROTECTION ASSOCIATION STANDARD.

Inside Diameter of Hose in Inches..	2½ inch	3 inch	3½ inch	4½ inch
Number of threads per inch........	7½	6	6	4

MALE COUPLINGS.

Outside diameter of thread finished......	3 1-16″	3⅝″	4¼″	5¾″
Diameter at root of thread.	2 8715″	3.3763″	4.0013″	5.3970″
Clearance betwen male and female threads	.03″	03″	.03″	.05″
Total length of threaded male end........	1 inch	1⅛ inch	1⅛ inch	1⅜ inch

The above to be of the 60 deg. V thread pattern with one hundredth inch cut off the top of the thread and one hundredth inch left in the bottom of the valley in 2½ inch, 3 inch and 3½ inch couplings and two hundredths inch in like manner for the 4½ inch couplings and with one-fourth inch blank end on male part of coupling in each case. Female ends to be cut ⅛ inch shorter for endwise clearance. They should also be bored out .03 inch larger in the 2½ inch, 3 and 3½ inch sizes, and .05 inch larger in the 4½ inch size in order to make up easily and without jamming or sticking.

COMPARATIVE STATEMENT OF DIMENSIONS REFERRED TO IN SPECIFICATIONS FOR "N. F. P. A." STANDARD HOSE COUPLINGS.

Fraction Inches	Decimal Inches	Centi-meters	REMARKS
	.01	.0254	To be taken off top and left in the valley of the thread in 2½ inch, and 3 inch and 3½ inch sizes.
	.02	.0508	Same as above for the 4½ inch size
	.03	.0762	Clearance between male and female threads in 2½ inch, 3 inch and 3½ inch sizes.
	.05	.1270	Same as above for 4½ inch size.
⅛	.125	.3175	Cut from female end for endwise clearance.
¼	.250	.6350	Blank end left on male couplings
1	1.000	2.5400	Total length of threaded male end for 2½ inc
1⅛	1.125	2.8575	Same as above for 3 inch and 3½ inch sizes
1⅜	1.375	3.4925	Same as above for 4½ inch size.
2½	2.500	6.3500	Inside diameter of hose coupling.
3	3.000	7.6200	Inside diameter of hose coupling.
3½	3.500	8.8900	Inside diameter of hose coupling.
4½	4.500	11.4300	Inside diameter of hose coupling.
	2.8715	7.2936	Diameter at root of thread, 2½ inch size
	3.3763	8.5758	Diameter at root of thread, 3 inch size.
	4.0013	10.1633	Diameter at root of thread, 3½ inch size
	5.3970	13.7084	Diameter at root of thread, 4½ inch size.
3 1-16	3.0625	7.7788	Outside diameter of finished thread, 2½ inch size.
3⅝	3.6250	9.2075	Outside diameter of finished thread, 3 inch size.
4¼	4.2500	10.7950	Outside diameter of finished thread, 3½ inch size.
5¾	5.7500	14.6050	Outside diameter of finished thread, 4½ inch size.

NOTE—The above table of comparative measurements presents at a glance the various dimensions of the standard coupling and is made to include the metric equivalents in order to demonstrate the adaptability of the standard to that system of measurement.)

This committee will cheerfully furnish any additional information desired upon application to its chairman, or through correspondence with any of its members, and we may add that our most earnest and active co-operation is at the command of all parties interested in the accomplishment of this much needed reform, of we may be favored with their valued suggestions as to the best means and methods of promoting its adoption in any community or throughout the whole country at an early day.

This committe realizes that however encouraging may be the fact that a standard has been established under the sanction and approval of those public bodies which control the use of same, it is not therefore to be considered that the task is finished and may be left to automatically work out the matter of substitution; there must be continued agitation, a campaign of education and appeals to those in authority to take prompt action, and in this effort we feel assured that we shall be honored with your earnest assistance, counsel and advise, and to this end we request acknowledgement of receipt of this circular at your early convenience.

F. M. GRISWOLD, Chairman, No. 56 Cedar street, New York.
G. E. BRUEN, Room 1001, No. 32 Liberty street, New York.
H. C. HENLEY, Century Building, St. Louis, Mo.
C. H. CAMPBELL, No. 431 Equitable Building, Atlanta, Ga.
Special Committee on Standard Hose Couplings
and Hydrant Fittings for Public Fire Service.

New York, March, 1906.
Adopted by the National Board of Fire Underwriters, June 28, 1906.

MR. HATTON: Mr. President, I have some correspondence from Mr. Griswold in regard to that matter, and I would say that I know more or less about it, having been on a committee which considered the same matter in the American Waterworks Association, and I would be glad to give some illustrations at some other session of the Convention about it, if it is agreeable.

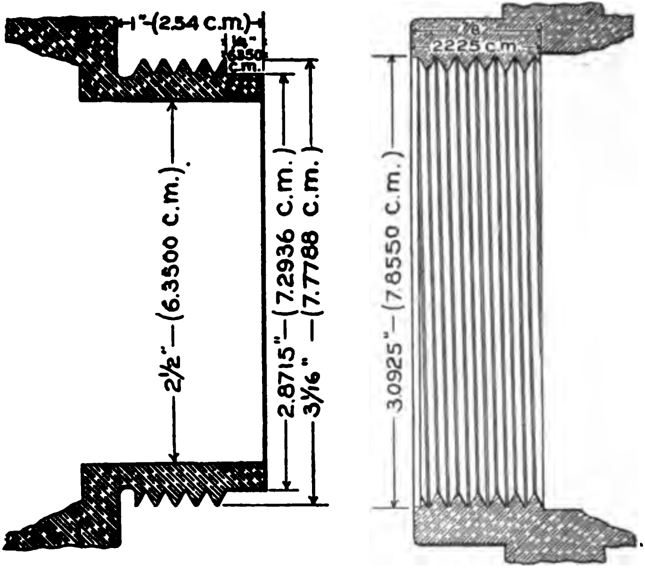
THE PRESIDENT: We will be glad to hear from you concerning that later.

THE PRESIDENT: Mr. G. A. Parker, Chairman of the Committee on Park Development, promised sometime ago a paper and report from his committee, but they have not yet appeared, but if they appear later, we will have them presented. Our program for

National Fire Protection Association Standard Hose Coupling.

	INCHES.	CENTIMETRES.
INSIDE DIAMETER OF HOSE COUPLING	2½	6.3500
NUMBER OF THREADS PER INCH 7½		
BLANK END ON MALE PART	¼	.6350
OUTSIDE DIAMETER OF THREAD FINISHED	3⅙	7.7788
DIAMETER AT ROOT OF THREAD	2.8715	7.2936
CLEARANCE BETWEEN MALE AND FEMALE THREADS	.03	.0762
TOTAL LENGTH OF THREADED MALE END	1.00	2.5400

60° V THREAD PATTERN 1/100 INCH (0.0254 CENTIMETRE) CUT OFF TOP OF THREAD AND 1/100 INCH (0.0254 CENTIMETRE) LEFT IN BOTTOM OF VALLEY. FEMALE END TO BE CUT ⅛ INCH (0.3175 CENTIMETRE) SHORTER FOR ENDWISE CLEARANCE.

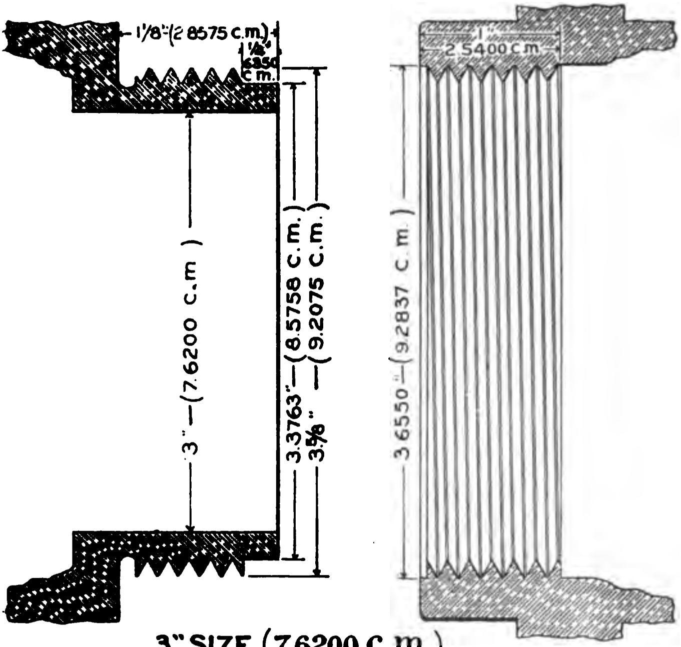


2½" SIZE (6.3500 c.m.)

National Fire Protection Association Standard Hose Coupling.

	INCHES.	CENTIMETRES.
INSIDE DIAMETER OF HOSE COUPLING	3	7.6200
NUMBER OF THREADS PER INCH......6		
BLANK END ON MALE PART	¼	.6350
OUTSIDE DIAMETER OF THREAD FINISHED	3⅝	9.2075
DIAMETER AT ROOT OF THREAD	3.3763	8.5758
CLEARANCE BETWEEN MALE AND FEMALE THREADS	.03	.0762
TOTAL LENGTH OF THREADED MALE END	1⅛	2.8575

60° V THREAD PATTERN-1/100 INCH (0.0254 CENTIMETRE)
CUT OFF TOP OF THREAD AND 1/100 INCH (0.0254 CENTIMETRE)
LEFT IN BOTTOM OF VALLEY FEMALE END TO BE CUT ⅛ INCH
(0.3175 CENTIMETRE) SHORTER FOR ENDWISE CLEARANCE

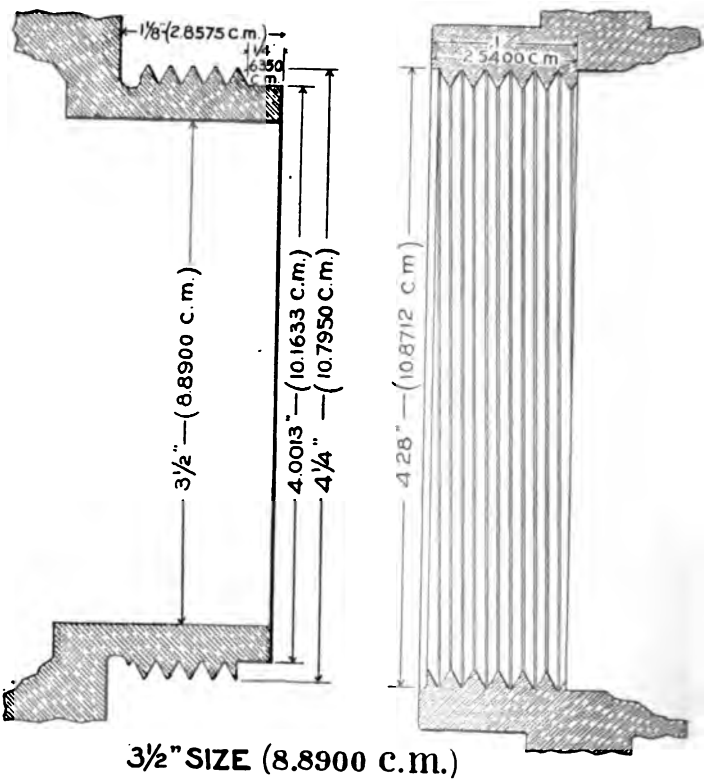


3" SIZE (7.6200 c.m.)

National Fire Protection Association Standard Hose Coupling.

	INCHES.	CENTIMETRES.
INSIDE DIAMETER OF HOSE COUPLING	3½	8.8900
NUMBER OF THREADS PER INCH 6		
BLANK END ON MALE PART	¼	.6350
OUTSIDE DIAMETER OF THREAD FINISHED	4¼	10.7950
DIAMETER AT ROOT OF THREAD	4.0013	10.1633
CLEARANCE BETWEEN MALE AND FEMALE THREADS	.03	.0762
TOTAL LENGTH OF THREADED MALE END	1⅛	2.8575

60° V THREAD PATTERN 1/100 INCH (0.0254 CENTIMETRE) CUT OFF TOP OF THREAD AND 1/100 INCH (0.0254 CENTIMETRE) LEFT IN BOTTOM OF VALLEY. FEMALE END TO BE CUT ⅛ INCH (0.3175 CENTIMETRE) SHORTER FOR ENDWISE CLEARANCE

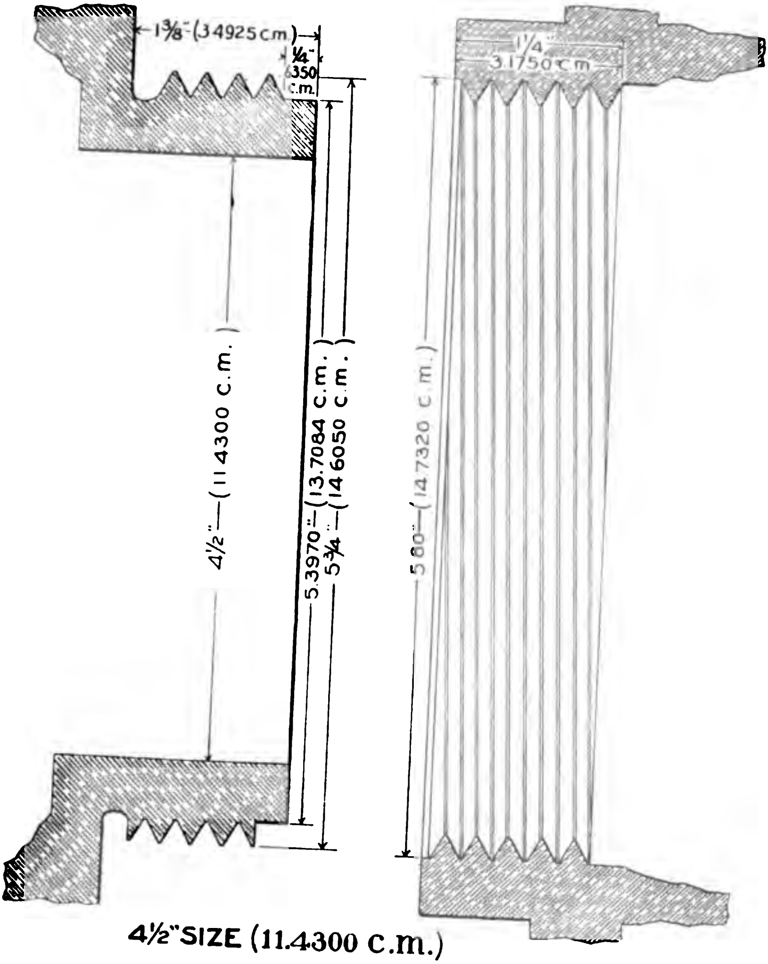


3½" SIZE (8.8900 c.m.)

National Fire Protection Association Standard Hose Coupling.

	INCHES	CENTIMETRES.
INSIDE DIAMETER OF HOSE COUPLING	4½	11.4300
NUMBER OF THREADS PER INCH.......4	......	....
BLANK END ON MALE PART	¼	6350
OUTSIDE DIAMETER OF THREAD FINISHED	5¾	14.6050
DIAMETER AT ROOT OF THREAD	5 3970	13.7084
CLEARANCE BETWEEN MALE AND FEMALE THREADS	05	.1270
TOTAL LENGTH OF THREADED MALE END	1⅜	3.4925

60° V THREAD PATTERN 2/100 INCH (0.0508 CENTIMETRE) CUT OFF TOP OF THREAD AND 2/100 INCH (0.0508 CENTIMETRE) LEFT IN BOTTOM OF VALLEY. FEMALE END TO BE CUT ⅛ INCH (0 3175 CENTIMETRE) SHORTER FOR ENDWISE CLEARANCE.



4½" SIZE (11.4300 c.m.)

tomorrow night will have to be limited in order to use a stereopticon, and we will have to put one or two papers over for tonight and bring one forward from Thursday to Wednesday, and I think it would be well to relieve tomorrow night's program of one or two papers. We will now have a paper on "Yellow Fever and Sanitation" read, by Mr. Hazlehurst, of Mobile, Ala.

YELLOW FEVER AND SANITATION.

BY J. N. HAZLEHURST, CONSULTING ENGINEER, MOBILE, ALA.

It is a matter of recent history that on the 21st day of July, 1905, the presence of yellow fever was announced in New Orleans, the metropolis of the South and the second port of export of the American continent.

In rapid succession new foci developed in many other parishes of Louisiana, from whence the disease spread to adjacent states, until on the 17th of November there had been officially reported 8,267 cases of fever with mortality of 900 persons, despite the most rigorous of quarantine restrictions.

It is unnecessary to recount the appeal made by the City of New Orleans for federal aid, nor the wonderful record made by the Public Health and Marine Hospital Service in eradicating the disease after a commencement which threatened to surpass in its virulent intensity the ravages of the fatal year 1878.

Since Major Walter Reed, of the United States Army, had so brilliantly proved the theory of the transmission of yellow fever, there had been no opportunity for a decisive battle against this foe, since the epidemic of 1900 in Havana, Cuba, and that of 1903, at Laredo, Texas, might be dignified only as skirmishes.

How the last great battle of an intermittent warfare waged for more than two hundred years was fought; the details of its maneuvers and tactics, and the final and complete triumph of science in this contest, are incidents of yesterday and scarce need repetition here, but the fruits of this victory may be estimated directly from the record of a more remote past.

Following the epidemic of 1878, Congress appointed a "Board of Experts" to investigate and report upon the facts in connection with that outbreak of yellow fever, which stated in part that during the pestilence at least 18,000 (and probably as many as 20,000) deaths from yellow fever had occurred during the epidemic, representing a loss estimated at $12,600,000, according to the assumed basis of valuation.

It was believed by this board that at least 120,000 cases of sickness from yellow fever took place during the period, and since the loss of time of these patients was a public loss, an allowance for this time of $1,500,000 was made.

To these sums was added the value of the labor diverted from the production of useful activity by attendants upon 120,000 sick persons, or $600,000 more.

Since it was assumed that at least 150,000 persons fled from their homes and passed an average of three months in enforced idleness attributable to this epidemic, this diminution of national wealth was fixed at $6.750,000, the whole loss directly caused by the fever of 1878 being placed by this board at $21,450,000, while there were other losses, not reducible to exact figures, such as depreciation of all values and interest upon same, which probably warranted the board's conclusion that "these losses have been variously estimated by others at sums ranging from one hundred millions to two hundred millions of dollars."

The investigation of the causes and the origin of yellow fever made by this board of eminent experts was barren of results, its findings being summarized somewhat as follows:

That yellow fever is a disease whose specific poison had never been demonstrated, but requiring favorable local conditions for evolution in epidemic form, the nature of such favorable conditions, however, remaining unknown, although yellow fever was observed to be a disease of singular local attachments. becoming epidemic in one section of a city to the exclusion of other portions, and showing remarkable indifference to topographical or social surroundings.

It was also noted that yellow fever, like other epidemic diseases, required a period of incubation between the introduction of the specific cause and the outbreak of the sickness.

Historically, it was shown that this fever in its epidemic form, was a disease of warm climates, its poison being rendered inocuous by freezing temperatures; also that the disease was first known in the West Indies, from whence its importation into Boston, in 1693, and all subsequent manifestations were directly traceable. Further, that in the United States yellow fever was an exotic, appearing first at the national seaports, but never having acquired permanent domicil.

The concluding and literal quotation from this report is worthy of careful attention:

"In its migrations across seas and continents, yellow fever has always followed the lines of human travel and commercial intercourse, and the rapidity, the frequency and the extent of its diffusion in space and time correspond strictly to the rapidity, the frequency and the extent of the communication between infected and uninfected places. No instance is known in which it has passed from one place to another in a shorter time than would have sufficed for a man to have made the same journey."

In view of these negative conclusions and the insiduous and deadly nature of the disease, little wonder that the report of any outbreak created immediate and uncontrolable panic in localities likely to become infected, nor that thousands fled precipitately before the approach of this mysterious and unknown foe.

In the light of subsequent discovery, the wonder is that the active agent of this disease should not sooner have been revealed, and that the real cause of all of this disorder should not long since have been suspected if only from the record left by medical and other qualified observers, a few such being quoted here in evidence. Thus a portion of a report made of a virulent epidemic of yellow fever in Charleston, S. C., and recorded by Assistant Surgeon Harvey E. Brown, is as follows:

"Along some of the principal streets I saw the cellars flooded with water. In the yards I was called into I saw on every side the accumulated refuse of the houses, the kitchen and the stables. * * * The heavy rains of the late summer and early fall had created a state of things well calculated, it seems to me, to generate disease.

"Through many parts of the town, in those (suburban) portions, ponds of water, stagnant and covered with green vegetation, existed. Some of these ponds, I was told, had been drained in former years because they occasioned sickness, and had always been kept carefully dry till this season, when from scarcity of labor they had been allowed to refill by choking up their vents. In many places new ponds were formed by unusual quantity of rain."

One of the most pregnant utterances of those days may be found in a history of the epidemic of 1878 in Chattanooga, Tenn., by Dr. J. H. Van Deman, as read before the American Public Health Association, at Nashville, the following year:

"First, its origin. For a solution of this question let New Orleans answer, for no one doubts that being the focus from whence the whole Mississippi valley became infected, it being carried from there along the course of our great rivers and our numerous railroads to every Southern port and town, almost, until it was traced even to our own mountain home, bringing death and desolation in its fearful track.

"What the cause? We answer candidly we do not know. However, that with us it commenced its ravages in the lowest and most filthy of our wards, raging in great malignancy and virulency in the places before mentioned. The more filth, the more yellow fever. The lower the ground, the poorer the drainage and water supply, there you would find this disease the worst. * * *

"What is the public remedy? I do not mean what medicine shall we give, for too much of this has killed as many as the fever itself; but what shall we do to prevent the disease from coming amongst us in our inland towns and our high elevations?

"We answer: Increase the sewerage of our city; build the sewers long and large; make them of moment; carry their outlets into the streams below our water supply and far out into our rivers; increase our surface drainage; remove our night soil; enlarge our water supply; fill up our wells (for in cities nearly all of them are sowing the seeds of disease)." * * *

As far back as the year 1704, Dr. James Carroll, writing of an epidemic of yellow fever in Baltimore, says:

"The unusual prevalence of mosquitoes during an epidemic of yellow fever has been recorded a number of times."

In Philadelphia, in 1787, Dr. Benjamin Rush noted that "mosquitoes abounded, as usual in sickly seasons."

Commenting upon a most maglinant visitation of yellow fever in Wilmington, Del., in 1802, Dr. John Vaughn observed:

"The season became tropical in the middle of August. The weather from being uncomfortably cool, suddenly became extremely hot, varying from 80 to 90 degrees, with frequent gusts of rain and lightning. * * * Myriads of mosquitoes infested the lower parts of the town from July until frost, having gradually diffused themselves over the borough in September."

Dr. J. C. Nott, of Mobile, Ala., in an article in the New Orleans Medical Review (1847), noted the fact that during seasons when malarial and like fevers were especially prevalent, mosquitoes were abundant, and upon this fact first advanced the hypothesis of the transmission of fevers through this agency, although making certain exception as to yellow fever, since he was unable to account for the observed fact that the mosquito habitually hovered near the ground while his practice had shown infection in the upper stories of houses.

Unable to see the handwriting on the wall, thus science groped its way until a Cuban, Dr. Carlos Finlay, in 1881, tore the bandage from unseeing eyes, and upon his hypothesis, an American commission, first in Havana, and later at Vera Cruz, demonstrated by irresistible proof the fact that a mosquito, of the genus *stegomyia fasciata*, after attacking an individual suffering from yellow fever, was capable of transmitting this disease to the human family. From a survey made by the United States government in 1893 to determine the life zone or geographic limits of the distribution of this particular insect, it became definitely known that this mosquito was self-perpetuating in all of the Southern states bounded by the Atlantic ocean and the Gulf of Mexico, with the exception of those portions of Virginia, North Carolina, South Carolina, Georgia and Alabama, which constitute practically the foothills of the Appalachian chain of mountains.

Within the section indicated, and classified as the "Lower Austral Zone," during the summer months, and particularly during seasons of extreme humidity and heat, the yellow fever mosquito propagates. According to Dr. L. O. Howard, Chief Entomologist of the United States Department of Agriculture, "during the late summer months and in September and even early October yellow fever mosquitoes are brought northward beyond the limits of the lower austral life zone in railway trains, and particularly upon boats going up the Mississippi and Ohio rivers. In this way the mosquito is carried north of its permanent breeding regions, and while the extreme heat lasts it may breed for a generation or two or even more at a point north of its permanent establishment."

The earlier history of yellow fever in North America presents positive evidence of the importation of this disease from the West Indies through the medium of trading vessels clearing from infected ports, although frequently no fever had appeared amongst crew or passengers, for which reason great uncertainty existed as to the active agency introducing the disease; the cargo, the bilge water and even the stone ballast in turn being suspected. Whether under normal or exotic conditions the yellow fever mosquito is found to exist, it only requires the introduction of the infected human for the commencement and continuance of its murderous work, limited or accentuated by local conditions. The mosquito responsible for the spread of yellow fever is a semi-domestic and non-migratory insect, breeding always in stagnant pools, rain barrels or other containers of water, under house drains in cities, but generally in fairly clean water.

The first opportunity in the United States for testing the so-called "mosquito theory," came during the summer of 1903, at Laredo, Texas, from infection traced to Tampico, Mexico.

At that time Laredo contained a population of some 18,000 residing on the Texas side of the Rio Grande river, and about 8,000 persons living on the Mexican section. Neither town possessed either storm or sanitary sewers, and their water supply was furnished by a chartered corporation from the turbid river, and was deficient both in quantity and quality, while the rates were such as to render its general use impossible to the poorer inhabitants and its character such as largely to forbid its consumption by others. Hence the almost universal use of cisterns, casks and other receptacles concerning which Marine Hospital Surgeon officially reported that "as a breeding place for mosquitoes and especially the *stegomyia fasciata,* it would be difficult to improve upon them."

In the same report he also stated that this species was found in enormous numbers and widely distributed.

Shortly after this outbreak, the Marine Hospital authorities assumed control, immediately inaugurating the then experimental work of fumigating buildings, screening cisterns and the oiling of pools, gutters and other likely breeding places of mosquitoes. According to an official report, "so thoroughly was the work of destroying mosquitoes and especially the work of oiling containers and other breeding places performed that an officer of the service detailed in Laredo to study infected yellow fever mosquitoes, could not find, after diligent search, enough *stegomyia* in the adult, larval or pupal stages to carry on his work."

In Laredo, from September, 1903, to March, 1904, there has been upward of a thousand cases of yellow fever with about ten per cent mortality, but for the first time in history the disease had been conquered before a killing frost.

During the late epidemic in New Orleans similar conditions largely existed, only a limited section of the city being provided with subdrainage, while all portions of the city were without sanitary sewers. The distributing system of the water works was entirely inadequate and the water supply being unfiltered, carried in suspension ordinarily as much as four tons of sedimentary matter to each million gallons of water, resulting in the almost universal use of cisterns, casks and such containers as may be inferred from Dr. White's report that at the commencement of the epidemic there was in use in the City of New Orleans 68,000 cisterns. Despite the headway gained by the fever there before the commencement of remedial action, and the adverse sanitary conditions, after 3,390 cases of yellow fever, resulting in 459 deaths, the disease was eradicated and all quarantine restrictions removed for more than a month prior to the first heavy frost.

While the triumph of science was again complete, the costs of victory were heavy, several hundred thousand dollars having been expended during the campaign, while indirect losses could hardly be estimated.

From the record of the past two facts have been absolutely demonstrated:

First, that complete isolation and non-intercourse from and with the outside world to be secured through unceasing vigilance can prevent a first infection of any community without the tropics. Second, that after infection and even under the most unfavorable circumstances and conditions energetic remedial measures directed upon scientific principles as now understood will control and effectually stamp out any epidemic of yellow fever.

While these facts are comforting assurances and mark a distinct advance, it is prevention rather than cure which should occupy the attention of those in authority, otherwise our cities, towns and villages, situate within the life-zone of this deadly peril, are forever doomed by fear of this introductory spark and through the instinct of self-preservation to maintain a costly and barbarous "shot-gun" patrol with the ever present possibility of accidental infection with all of its attendant hardships and misfortunes to stricken communities.

Students of this subject can hardly fail to become impressed with certain facts in connection with the recurrence of yellow fever in the United States since its first entry; first, that while yellow fever formerly raged in many of our Northern seaport towns, it has made no visitation north of the Mason and Dixon line for so many years that apprehension as to such epidemic in those sections of the country no longer exists. Second, that while formerly an epidemic in the South continued its spread into nearly every city until its course was checked by frost, since 1878 fewer cities were invaded and that certain cities, often far removed from each other, seemed to suffer under a peculiar fatality in respect to its attack.

Science must discover some reason for these facts. An explanation given by Dr. J. H. White, of the Marine Hospital Service, as to the disappearance of yellow fever from Northern cities is certainly entitled to respectful consideration, and is as follows:

"It would be a false claim, if set up by any of our great Northern cities, that they intelligently provided themselves with municipal utilities which appealed strongly to their ideas of creature comfort and general cleanliness, and which incidentally and entirely accidentally eliminated the mosquito at the same time. These public utilities were a thoroughly controlled water supply, sewerage, drainage and pavements, and these four, not one, but all of them, were essential to the end attained."

Dr. White's contention is that although accomplished accidentally, the agencies directly responsible for the elimination of yellow fever, were the introduction of these public utilities which prevented the propagation of the mosquito.

Let us consider the evidence in support of the fact that these same agencies may be relied upon to prevent the recurrence of yellow fever within the section now known to be the habitat of the insect responsible for the spread of this disease. Parenthetically it may be remarked that seldom does the construction of water works, sewers and street pavement occur simultaneously, but generally in the following order:

First, water works are built; secondly, sewers are demanded to remove the waste water of the water supply, and lastly, after water and sewer pipes are laid, the streets are paved, the surface drainage being an incident of this latter construction.

After the epidemic in Memphis during the year 1878, when, according to Keating, some 17,600 cases of yellow fever occurred, resulting in 5,150 deaths, and the return of this disease the year following, Col. George E. Waring, C E., was retained to design and construct a system of sanitary sewers, the first comprehensive application of the separate system upon this continent.

Concerning the potentiality of these sewers in the prevention of another disaster from like cause, Colonel Waring made the following remarkable prophecy in his address before the American Public Health Association at Nashville, Tenn., November, 1879:

"I trust that, as I am neither a Southerner nor a physician, I may be excused for attaching more importance than many of you probably do to the proper drainage and cleaning of a city, and to the proper disposal of its outflow, and more than to any system of quarantine. My knowledge of the history of the yellow fever epidemics in this valley is infinitely less than yours, but I feel warranted, and I take my warrant from the history of the plagues which devastated the filthy mediæval cities of Europe, and from my own knowledge of the want of cleanliness and want of drainage in the City of Memphis, in venturing the suggestion that even that fever-smitten town may be made an impossible field for the invasion of yellow fever in epidemic form."

While Colonel Waring's theories probably had few converts, the necessity of doing something toward securing relief from this scourge drove the people of Memphis to commence its sewer system which now comprises 210 miles of sanitary and four miles of storm sewers.

Since the first work was inaugurated, Memphis, although frequently menaced, escaped any attack of yellow fever until the year 1897, when the plague being general throughout the Mississippi valley, fifty cases and fifteen deaths were accredited to Memphis.

From a population of 33,592, according to the census of 1880, that city had grown to 102,320 inhabitants in 1900.

From a recent letter from the City Engineer of Memphis regarding the situation there in 1897, the following is quoted:

"Regarding fever conditions here in '97, beg to say I have investigated the matter and find that we had fifty cases and fifteen deaths. All of these cases were distinctly traceable to one locality except one, which was shown to be imported from New Orleans. The infected district was unsewered. It was inhabitated principally by people of the lower class. It was partly paved and had water connections."

Before the year 1880, no city in the South had more than a most fragmentary system of sewers, but after the example set by Memphis, the larger towns, one by one, inaugurated more or less extensive and comprehensive systems of sewers, until of the principal cities there remains unsewered only New Orleans, Vicksburg, Pensacola and Galveston.

Systematic effort has been made by the writer to secure statictical information as to paving, sewerage, water supply and like municipal improvements of all the cities located within the fever zone. and as well, the dates since 1878 showing recurrence of yellow fever in each.

Reports from more than twenty such cities show that, exclusive of Memphis, whose experience has been recited at length, only four towns have been afflicted with yellow fever since the construction of systems of sanitary sewers. These towns are Montgomery, Ala., Natchez, Miss., Baton Rouge and Alexandria, La.

The most important of these towns is Montgomery, whose sewers were constructed in 1889, and despite which, suffered from fever in 1897, 134 cases being reported during that year. At the time these sewers were constructed the city had a population of only about 20,000, and this had expanded to more than 30,000 at the time when the epidemic occurred. It is also reported that the fever at that time existed only in sections of the city which were unsewered and that no case was recorded within the sewered districts, indicative of the fact that the city had outgrown its first sewerage works.

Natchez, Miss., during the past year suffered by yellow fever to the extent of 143 cases and seven deaths. This city has forty-five miles of unpaved streets, seven miles of sanitary sewers and two miles of storm sewers. According to official report. only two cases of yellow fever occurred in dwellings provided with sewer connections. It is also reported that connection to sewers is not compulsory, and few such have been made. The sewers were constructed and owned by a franchise corporation supplying the city with water. Numerous cisterns are in use owing to a deficient water distribution and supply.

Baton Rouge, which also reported ten cases of fever and one death during the past epidemic of fever, has also a deficient water system, owned by a private corporation, and relies also largely upon cisterns and like water containers. In 1901 seven miles of sanitary sewers were constructed by the city, but only 150 connections have been made voluntarily.

Lastly, the town of Alexandria, La., built its nine miles of sanitary sewers during the year 1900, and in this town connections are compulsory. During 1905 nineteen cases of fever were returned, with one death. Concerning conditions there during the fever continuance, the city engineer writes as follows:

"While the city water is generally used, a considerable number of the population have tanks, cisterns and barrels for gathering rain water. * * * The spread of the fever in this place seems to have been due entirely to the quite extensive use of cisterns which were not screened, and so formed breeding places for the mosquito."

Alexandria is built upon ground extremely low and flat, and open canals and ditches are relied upon to remove the storm waters. It is especially worthy of note that during the epidemic of 1905 New Orleans, Vicksburg and Pensacola were the principal sufferers; cities deficient in sewers of all descriptions and in contrast, during the same year refugee or imported cases of fever occurred in Montgomery, Ala., Tampa, Fla., and Shrieveport, La., cities which in the past, from such infection would undoubtedly have been quick to respond, but no spread of the dread disease occurred. It is significant that these three cities have been effectually sewered and connections are made compulsory.

If such statistical facts are considered merely coincidences, in further support of the theory that sanitary sewers, especially when augmented with an abundant and suitable water supply may be relied upon to prevent the spread of yellow fever, the cases of Vera Cruz, Merida, Yucatan, and the City of Havana may be cited. The first of these cities was sewered and paved about three years since, and although for generations, each year witnessed an outbreak of yellow fever, whose virulence was limited only by the extent of the immune population few cases and no epidemic of yellow fever has since been reported.

The City of Merida, following the example of Vera Cruz, has lately expended something more than four millions of dollars upon her public utilities. This city of the tropics, accustomed each year to reckon the victims of yellow fever by the hundreds, reports only ten cases of fever for the fiscal period, accounted for by a recent press dispatch, as follows:

"This great improvement is due to the improved system of isolation and the institution of modern sanitation."

But that isolation alone may be expected to fail in providing adequate protection may be well suspected from the late experience in Havana, a city where this method of protection may be admitted to have reached its highest development. Infected from the epidemic of 1905 at New Orleans, and despite the most active efforts of its health officers, yellow fever made marked progress there, and resulted in the establishment of quarantine restrictions against that city upon the part of North and South American seaports. Havana has no system of sewers.

In view of the evidence submitted, the deduction seems warranted by the facts that even a city in the tropics may be freed entirely of yellow fever by providing modern municipal utilities, and the potentiality of these agents must be far greater when applied to communities where yellow fever is known to be exotic; hence the writer feels fully justified in the assertion made by him at the close of the campaign inaugurated by the Mobile Auxiliary Sanitary Association, as follows:

"What has been written is not intended to belittle or detract from the intelligent effort of our local health board in its successful maintenance of scientifically formulated quarantine regulations, nor to underestimate the work accomplished by this Association, but that the fever has not fastened upon our city, seriously menaced though it were, is probably neither a miracle, due to a special dispensation of Providence, nor to the preventative and remedial measures exercised during the present crisis. While each has done what he could, with the previous installation of a bountiful water supply and the construction of a comprehensive system of sewers, followed by the completion of a considerable area of street paving, exercising reasonable prudence and precaution, no longer need Mobile tremble at the outbreak of fever in this section, for danger from this source has passed for all time."

THE PRESIDENT: The paper is now open for discussion, gentlemen.

MR. WEISSLEDER: I have listened with much interest to the reading of this paper, and it is a serious one, and I would not revert to this but for the fact that Cincinnati raised thousands of dollars to help Dr. Clark Davis welcome the refugees from the South, and who treated hundreds of cases of yellow fever in its incipient stages in Cincinnati; while there was a clamor against it, the citizens through the council voted large sums of money as an emergency fund to help these refugees, and I think it was a proper action on the part of the citizens of Cincinnati, and it was only humane. I move that this paper be placed upon the records of this convention, and that we extend a vote of thanks to the gentleman for it.

SECRETARY: I might say that I was associated with Col. Waring in the Memphis sewerage, and had an opportunity to learn something about the general situation and the condition of the city, and their methods of taking care of the sewage. There were only four or five sewers in the city previous to 1880, which connected the principal hotels and which run by tunnels direct to the river. The custom was to dig cesspools in the yards just where they happen to want them, use them until they are filled up, then instead of cleaning them out, simply cover them up. I remember distinctly one place where we had to run a long connection of 120 feet through yards where we passed through four of these cesspools that had been filled up without any attempt to clean them out. You can imagine the conditions we found when we went through them. This matter, whatever you may call it, was partially decomposed, and it has always seemed strange to me that the epidemic did not break out before and that it did not carry off more people that it did at that time.

Mr. Hatton: Mr. President, it must have been a very serious thing for the people in the South that was visited with yellow fever, to try to find out the ways and means of preventing it, before they discovered that the mosquito was alone responsible for the fever. And when they did find the mosquito was responsible for it, it seems to have explained all the acts that had formerly been ascribed to something else. For instance, during the last epidemic in Pensacola, and I have become quite familar with that one, the yellow fever was entirely or almost entirely confined to the lower districts of Pensacola. Pensacola lies low in the business districts and half a mile back from the bay it rises to a point 65 or 75 feet with a pure sand foundation, and no water lying upon the surface, whereas in the lower part of the city there are two or three streams backing in from the bay and the water lies in those low places. Nearly all of the yellow fever cases were in those low sections and none whatever except an isolated case up in the upper portionof the city, showing conclusively that it is the drainage more particularly than the water supply that causes the trouble. We put forth too much thought on the question of a pure water supply and not enough to drainage. It showed conclusively that what the City of Pensacola needed was drainage, in as much as it had one of the best water supply systems, so far as the purity of water is concerned, of any city in the United States. As soon as they awakened to the idea that it was the stagnant pools of water lying around in the lower sections that spread the yellow fever, they drained those out and spread them over with antiseptics, and the yellow fever began disappearing, and this paper of Mr. Hazlehurst's describes the situation in the South better than any other paper on the subject that I have ever heard read. I think the Society owes him a debt of thanks for preparing it with the great labor that he has done.

THE PRESIDENT: The thing that impressed me more in the paper was the fact that the last epidemic in Memphis they had fifty cases and fifteen deaths; they all occurred in a limited section of the city which had not yet been sewered, and no case except an unimportant case or two appeared in any other part of the city.

Also, the emphasis the paper puts upon paving as being a part of the improvement which is really necessary in order to reduce the danger of yellow fever. That is really only a branch of the subject, because all good paving simply means that you have reduced the amount of water which stands on the surface in public land of the city, and the necessary consequence in putting in the pavements is, it carries the water off. Is there any other discussion, gentlemen?

MR. WEISSLEDER: There is one remark I would like to make, and that is this: the paper referred to the matter of low temperature disposing of the fever and preventing it. In 1882 Professor John Gambee, of London, England, devised a method of disinfecting the holds of ships. He was employed by some department of the government to erect a plant at Galveston, Texas. He used sulphuric acid, common clay treated with hydro chloric acid, which produced chloride of alumina, and made a solution of same, and that was brought down to a low temperature, nearly freezing. He pumped that through the holds of the ship, and the bilge water displaced by putting the chloride of alumina in the water he disinfected by low temperature, as well as the chemicals used, and I think possibly some of us remember that work in 1882.

THE PRESIDENT: If there is nothing further in the way of discussion, those in favor of the motion to spread the paper upon the minutes of the convention, will make it known by the usual sign, those opposed, no. The motion is carried and it is so ordered.

THE PRESIDENT: We have one more paper for tomorrow night we would like to bring forward at this session, and that is the paper by Mr. W. H. Luster, Jr., on the "Improvements of Elizabeth River by Eliminating Sewerage Pollution."

THE CONTEMPLATED RIVER IMPROVEMENT AT ELIZABETH, N. J.

BY W. H. LUSTER, CITY SURVEYOR.

The sanitary and aesthetic conditions governing streams, which have been made receptacles for the sewage of towns, have, of late years become subjects of great prominence, by reason of the increase in population, and consequent greater pollution of the streams, and also what may be called an advance in all classes of people to a higher sanitary and aesthetic civilization.

Forty years ago a small stream or water course that had the proper grade to convey sewage to another locality, was regarded as the proper economical place for such disposal, and the nuisance which was to come, never entered into consideration of the problem.

The City of Elizabeth, N. J., a city now having a population of 65,000, is reaping the whirlwind of such construction.

About forty years ago it was decided that a sewer system was necessary, and the city surveyor submitted plans for the system, delivering the sewage to the water front of Staten Island Sound, where it would have been easily absorbed by the sea water; the great cost of this plan defeated it, and as a substitute, he prepared plans which drained nearly the entire sewage of the city into the Elizabeth River, a small stream, tributary to Staten Island Sound, and tidal and navigable for about two miles from its mouth.

At the time of building the system the upper portion of the stream was utilized as a mill pond, and the largest sewer in the city, emptied its contents just below the dam.

The drainage area above this dam was about 21 square miles, and in the dry weather period very little water flowed to the pond. The day's work at the mill nearly exhausting the supply and the night filling it again. This flow of the water during the day sent the sewage down the stream, so that until the dam was carried away by freshet, nothing very obnoxious was noted, but since then, the increase in population, the use of some of the water above the sewer for public supply, and clearing the land of trees, has caused a greater volume of sewage to flow into a diminishing volume of water; at one period Mr. Francis Collingwood, (M. Am. Soc. C. E.) measured the volume of stream and sewage flow and found the dilution was only one in six.

Elizabeth has the combined system of sewers, and sizes were computed by the formula

$$\log D = \frac{3 \log A + \log N + 6.8}{10}$$

and until about twenty years ago no great complaint was heard as to the efficiency of the sewers in time of storm, or contamination of the river by deposit of the solids of sewage, but as pavements were laid, houses built, and the population increased, the sewers became gorged during storms, and the river became vile, and during the past few years these conditions have increased to an alarming extent.

In some localities storm water sewers have been constructed which have relieved some of the congested districts, and now a demand for the purification of the river has reached such proportions that the city will have to eliminate sewage from it, in order that the stream may be sightly and inoffensive to the nose.

Notwithstanding popular clamor, the writer does not believe that the present condition of the river is or has been the direct cause of any illness in our city, but in his opinion the improvement will be made simply from an aesthetic point of view.

The writer has had this subject under .consideration for several years, but never until the past year has he had the opportunity or means placed at his disposal for a systematic study of the conditions; but during the year 1905, the public demand for improvement became so great that he was directed by the city council to study the situation, and prepare plans and furnish estimates of cost for such improvement.

The writer found seven trunk sewers, ranging from 2 feet by 3 feet to seven feet circular opening, and twelve pipe sewers, from 10 inches to 18 inches, draining into the river at elevations from 0.00 to 5 feet above mean low tide, all being within a distance of about 1½ miles. The tidal flow at certain stages of the tide carried the sewage from the lower sewers up stream, depositing the solids along the bed and sides, and the retrograde movement deposited the remainder, and those above the tide, by reason of the small velocity and inequalities in the river bed deposited their share of filth.

The velocity at no time, except during freshet, is over two feet per second, and the average velocity is not over one foot per second, the dilution, as stated before, is at times, only one in six, in the upper part of the river; while where it is subject to tidal action, the dilution is much greater, so in the dry weather period it is exceedingly offensive to eye and nose.

Adjacent property owners have made the situation worse by throwing all kinds of waste material in the stream, including tin cans, stove pipe, decayed vegetables, old bedding, baby carriages. bottles and dead domestic animals. This practice, with the sedimentation of sewage. and the deposit of mud from freshet and storm, have filled the river from one to two feet, making the invert of the most important sewer about one foot below the present rived bed.

To relieve this intolerable condition and render the stream sightly and inoffensive was the problem; that it can be accomplished is shown by the condition of the water above the sewers, which part of the river is not tidal, where it is clear and shows no signs of pollution, and fish live in it, but below the sewers, all the higher organisms are absent.

Mr. Francis Collingwood, M. Am. Soc. C. E., some years ago, reported a plan to clean the river, and the writer, in his investigations came to the same general conclusions, as the result of his work. and with but several minor changes in route and the elimination of tide gates, the plans are identical.

The problem resolved itself simply into the question, How shall we divert all the sewage entering the river, without disturbing the present sewers to any great extent, taking into consideration the fact that nineteen sewer outlets, at elevations of from 0.00 to 5 feet above mean low water, all enter the river at a distance of over a mile from the water of Staten Island Sound?

Manifestly, it is impossible to take all the sewers to the sound by gravity, without radical changes in the old system, and as the demand is for the total elimination, the question resolved itself into two phases: First, either a complete change in the sewer system of the city, reconstructing it at a cost of over a million dollars, and placing the outlets at points on the sound shore, to where it would flow by gravity, or, second, to leave the present sewers and build an intercepting sewer under them, and then raise the sewage by pumping to a height sufficient to let it flow by gravity to the sound.

Investigation showed that the old sewers were in a good state of repair and now fairly efficient in carrying off storm water and sewage. Their condition may be gauged by the fact that it costs only $4,000 per year to clean and keep about sixty miles in repair.

A gravity system of intercepting sewers without change in the existing sewers would not completely eliminate the sewage from the river, and the sewer would be so flat that it would be filled with tide water for about two miles, causing deposits which would be a cause of expense, and at high tide they would not be effective in certain localities.

The above facts led the writer to abandon any new system involving radical changes in the present trunk sewers and the only way left was to tap the existing sewers, divert the sewage and pump it to a higher level, and dispose of it in the Staten Island Sound at some point where the odor will not be obnoxious, and where the tide will carry it away and absorb it quickly, and the following was the plan recommended:

Build an intercpting sewer on both sides of the river, of sufficient size to take not only the sewage, but the first flush from storm, joining them together below one of the present large sewers, and continuing to a pumping plant, lifting the sewage about eighteen feet, and from there let it flow by gravity to Staten Island Sound to a point which is probably one of the best sewer outlets in the State of New Jersey.

The sizes of the sewers were computed by Kutter's formula, and the quantities were computed from an estimated prospective population.

All the sewers entering the river are from a strictly residential portion of the city, and no factory waste enters it. The building plots are large; but in estimating the quantity the fact that the land might be subdivided later was taken into account, and 12½ lots per acre was used, with 5 persons per lot, with an allowance of 50 gallons of water per capita per day. At present the lots average about six to the acre.

In locating the position of the pumping plant the writer took into consideration that at some future date it might be advisable to purify the sewage before final disposal into tide water, and the system adopted and the location adapts itself to a plan of that kind without any change in the trunk sewer or pumping plant, it being located about an eighth of a mile from a tract of ground that is so situated as to be ideal for that purpose.

Many writers on the disposal of sewage into sea water claim that there is no necessity for purification unless the fisheries are of such value as to warrant the expenditure. The fisheries in our immediate vicinity are and were immaterial, but small as they were they have been practically destroyed by sewage and factory waste, and the water presents at times that greasy turbid appearance so noticeable at sewer outlets. This condition is on the increase, and finally as municipality after municipality make the waters of Staten Island Sound and New York Bay the place of sewage disposal it will increase the pollution until either the State or Federal Government will demand that such pollution cease. If the disposal into sea water was permitted by only riparian municipalities the danger would be far in the future, but riparian municipalities have constructed trunk sewers through private lands and through streets of other municipalities until our inland tidal waters now show the effect, and the proposed sewer from Patterson to tide water is another project that will add its mite to the ever-increasing pollution.

That the sea water in our vicinity is polluted I will state as an evidence that the teredo has ceased to be a cause of alarm to dock builders along the Hudson River and Staten Island Sound.

In view of these facts the writer deemed it advisable to recommend an intercepting sewer system, including pumping plant which would adapt itself to purification later, and not consider what in this case would be the more expensive system of gravity disposal to sea water.

In the plans adopted, the danger of a stoppage of the pumps would be slight, for in such a case the sewage would flow into the river by the old outlets, but for such short periods of time that no serious damage would be the result, as the water is not used for drinking or commercial purposes.

After eliminating the sewage the banks and bed of the stream are to be thoroughly cleaned from the head of navigation to a point about 1,000 feet above the upper sewer and the bed brought to a regular grade.

This cleaning and grading will give some relief from freshets, from which we suffer occasionally, and give a greater velocity to the water, so in case a stoppage of the pump occurs, the velocity will soon carry away the objectionable matter which will then flow into the stream.

The entire cost of the plan is about $200,000, and any one familar with the stream will say that it will be money well spent.

THE PRESIDENT: The paper is now open for discussion, gentlemen.

MR. SHERRERD: Mr. President, one phase of the question of the construction of such a sewerage system as has been described in this paper, that is, the construction of intercepting sewers, to take the flow out to salt water, where that is available, in connection with trunk sewers, might be of interest; it is a problem in connection with the distribution of cost, which is causing a good deal of consideration in connection with the project. The fact that many manufacturers, manufacturing plants, dye concerns and factories which have a very large amount of waste, located along the rivers, discharge directly into the rivers, so that when you construct an outlet for the sewage, you must, in order to purify the river, take care of those factory wastes in some manner. This question is very important because the waste alone amounts to more than the entire sewage of a city of 100,000 population, and I imagine that the same problem presents itself in other cities, that is, whether it is fair for the city at large to pay the added burden of the maintenance—especially where pumping has to be resorted to for the discharge of the sewage. It is due to the large factory waste, and perhaps it is in connection with the distribution of cost—some such basis as this to be used; that the rate of the capacity on which the sewers are constructed, be used as the basis, say, if is on the rating of 150 gallons per capita, or 200 gallons per capita, that the mills which are getting the use of it be asked to pay an additional sum, for their wastes are more than that rate per capita,—the number of hands employed in the factory. This would act in two ways, one in reducing the burden to the municipalities, who have to maintain sewers, and the other to make it the object of the mills to treat their waste, and so reduce the amount of the discharge. A number of the mills have found it economical to do that, and perhaps other mills will also find it so.

Mr. Hatton: Mr. President, the disposal scheme this paper suggests is the same old scheme after all of discharging the liquid wastes into Staten Island Sound. Now, any one crossing the river from either Hoboken or Jersey City, or going across to Brooklyn, is struck with the foul looking water over which they sail. The people in that section have undoubtedly all seen it so many times that their point of view is entirely closed; and from time to time these municipalities surrounding New York City have discharged their sewage and manufacturing liquid wastes into the streams and they all get down finally around New York City and that vicinity. The time is coming, and I do not think it is far off, when those five or six millions of people that now contribute to the pollution of that water, must find some means, as the City of London did, to get rid of that pollution. The National Board of Health of the United States has considered that question carefully in three of their meetings, and the condition of the water around New York harbor has been before them and discussed by the members of the board, and there was a resolution passed by that board of health suggesting to congress an act by which the pollution of the streams under government control should be stopped. While that paper is a very excellent paper, it seems to me that the writer has not touched upon that point as strong as he might have touched on it, because in his paper he realizes that by carrying out his system of intercepting sewers, he is still adding to the pollution of that water. Nearly every society of this character has at one time or another passed a resolution or suggestion that municipalities throughout this country should condemn the custom of discharging crude liquid household and manufacturing waste into their abutting streams, and it seems to me that this organization might lend its voice for the same purpose. We are in the South at this meeting,— and I trust I am not getting off the point—where very little has been done or agitated in that way; they are still discharging or largely discharging their crude wastes into the nearest water course, and the time is coming when they will find out their mistake, and I think it would be well for this Society to consider that matter before adjournment.

Mr. Weissleder: The last gentleman's remarks came home to the facts as existed in Cincinnati years ago; the water supply was being improperly polluted, and the question arose what would be done. The building of a new water works was undertaken and is nearly finished, and it will give us a better water supply away from sewage contaminations, and no doubt every community is interested in that question.

Mr. Sherrerd: I would like to say this, that this question of the polluted condition of the New York harbor has been pretty well and thoroughly investigated by a Commission of Five, I think, appointed by the Governor of New York, and, I think, the speaker preceding me in referring to that matter has probably gotten one side of the story only in connection with the filthy condition of the harbor, because certainly the New York State Commission, while admitting that their own citizens, at least three millions of whom discharge directly in the harbor, agree that as yet that has not affected the harbor,but to put the sewage of half a million more in there from Jersey would be a very considerable detriment, although the Jersey sewage is out three miles in the harbor. The report, or conclusion of the report seems to be that the present rate at which the contamination of the harbor is proceeding, something must be done, and it seems to us that those who happen to be in the other city and reside in Jersey, that we might join with them in discharging into the bay for a few years at least, because our sewage goes there anyway, as theirs does. The question is one that I think has perhaps been taken up by the National Board of Health on the suggestion of the New York people, but I do not think any ruling has ever been made on the subject. The remedy I think will be eventually that the sewage of the entire Metropolitan district must be collected and perhaps first for a while discharged in the upper harbor, and then afterwards subjected to some sort of treatment, and that's the method that the half million people in Jersey hope to introduce in connection with the trunk sewage. Around Boston, where they discharge their crude sewage into the harbor, there is some objection to the discharges. I think the principal one has been at Moon Island, where the sewage is held in reservoirs and discharged in large quantities at certain dates, the object being in that method of discharge to discharge it on the ebb flow to get it out in the sea.

THE SECRETARY: I am very glad to hear from the gentleman who has just spoken that the conditions as partially set forth by Mr. Hatton are not entirely so. I fully agree with him, and I think everybody will who has ever been across New York harbor, that the waters are in very filthy condition, but the gentleman has just stated that the people of New York were so alive to the situation that they were unwilling for the sewage of 120,000 Jerseyites to be added to it. While the New York people may have objection to the Jersey sewage and Jersey mosquitos, they certainly have no objection to the Jersey people. But seriously speaking, the question of the pollution of New York harbor has been taken up seriously, as stated by the last speaker. A state board was appointed to consider and make report on the matter. The life of this board expired by limitation last winter, and it made a report to the legislature, and a bill was passed by the legislature making or creating a new commission, and the commission has been appointed by the Mayor of New York, and is to take up the matter in a systematic and thorough way with a view to eventually entirely doing away with the pollution of the waters in New York harbor. It certainly must be done in a comparatively short time, when we consider that there are over four millions of people in the city and that it is rapidly growing and the water is being used and churned up and stirred continually.

Mr. Hatton: Mr. President, I believe as a matter of fact the necessity of doing something for the harbor towards purifying the water is more from an ethical sense of view than from the point of health, is it not?

The Secretary: I don't think so.

Mr. Hatton: That is, there is no water used for domestic purposes taken from the harbor?

The Secretary: Not at all.

Mr. Hatton: Then that comes back to the proposition stated in the paper that the purification of the stream was purely from an ethical point of view, and it is right and proper that we should look at it very largely from that point of view, aside from any point of view of health. We want to purify the water and streams; they are given to us in a pure state, and we should keep them in a pure state.

Mr. Parkes: As a farmer from a farming country, I want to rise to say that all this talk about New York harbor does not interest us. If some of the brothers would come as far as Baltimore tomorrow, we would be glad to hear about it; don't stand around in New York all day.

The President: I do not know whether this is an entirely ethical question or not. I have a branch of it under consideration which is likely to be more than that, if they are able to do what they seem to be willing to try to do. Some one is preparing the definition of what is pollution of a stream, and is trying to get it in shape so that it can be adopted by the legslature and put in shape to prevent men from throwing apple cores in streams for that matter without danger of arrest. It seems to me that if it comes to that point it will be a very practical question. Of course they are going at it from an ethical standpoint. I have that definition now under consideration, and I am trying very hard to find some way to present the subject, so that it will have some reasonable idea in it. It seems to me that we must look at this thing from a good many different points of view, the taking care of the purification of wastes, and there are several different things to do. I have for example this thing which will illustrate what I mean. A small system of sewers which has been completed,—a very large tannery has been allowed to discharge in it,—in fact their former discharge has been taken up, and their present connection with the sewage is all they have, and they discharge their refuse in the sewer without any purification whatever. It has very nearly stopped the sewer up twice, besides producing a very objectionable odor at its mouth. Now we have simply said to them, or to that tannery, you cannot discharge into this sewer any longer unless you will purify your discharge sufficiently so that it will not cause the deposits in the sewer that we have at the present time. We have a sewerage plant for a settling basin, and when that is completed we will have done away with the damage to the sewer itself in the way of stopping it up, and doing away with a large part of the damage of the streams by the deposits out of the outlet of the sewer. In this particular case, the settling of the waste before it is discharged in the sewer, will remove all practical difficulties. Now what I am doing or tryinig to do with reference to this definition of pollution, which we are trying to enact in a law is, to change it so that there will be some sort of elasticity to the definition so as to view circumstances practically as well as ethically.

Is there any further discussion of this paper; if not, I want to call your attention especially to the exhibits at this time; I think they are practically ready for you to see them, and we have left an hour or so before dinner time for you to go into that room. We will have a good program this evening of five or six papers, one or two of them I think we will have to discuss, and will be glad to have you come promptly at 8:00 so that we can get through without trespassing on our time.

I believe the Secretary has some announcement to make.

THE SECRETARY: I desire to offer this resolution:

Resolved, That Section 1, Article VII of the Constitution be amended by striking out the word "Wednesday" in the first sentence, and inserting the word "Tuesday," so that the Section will read:

"Section 1. The annual meeting of the Society shall be held on the second Tuesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected; provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2."

THE SECRETARY: I desire to also read this communication from the Birmingham Athletic Club:

BIRMINGHAM, ALA., Oct. 9, 1906.

The Board of Governors most cordially extend the privileges of the Birmingham Athletic Club to the members of the American Society of Municipal Improvements and trust you will take advantage of the many attractions to be found in our building.

Reading and writing rooms, lounging rooms, pool and billiard parlors, bowling alley, chess room, a complete gymnasium, a complete bath room, including a large swimming pool, will be placed at your disposal.

We will be glad to have you with us and those desiring to take advantage of this invitation may obtain visitor's card by calling at the Club Building, Twentieth street, between Fifth and Sixth Avenues.

Very truly,
C. H. MILES,
Secretary.

THE SECRETARY: Through the courtesy of the Birmingham Street Railway Company, all badges of the Society will be accepted on street cars good for a fare, so that no fares will be required of anyone wearing the badges.

MR. HATTON: I move the thanks of the Society be extended to the Athletic Club and to the Birmingham Street Railway Company for their courtesy in these matters.

THE PRESIDENT: I will take the liberty of referring these matters to the Committee on Resolutions, which usually takes care of those matters at the close of the meeting.

THE PRESIDENT: I want to make a couple more of announcements, and that is with reference to the trips tomorrow. On Thursday morning promptly at 9:30, Mr. Bowron will give an explanatory address on the Birmingham District. He will tell us about the trip we will take tomorrow, and also the one on Thursday, and will explain the different classes of industries which we have here. The carriages will start from the city hall at 10, and you want to be sure to be here before 10:00, and my advice to you would be to be here at 9:30 in order to hear Mr. Bowron's address. On Thursday morning our trip will be by train, and it will leave on schedule time. We want to start from the Union Station, where we all came in, and we will start promptly at 10:00, so that any of you that are not there at 10:00 will get left; now besides that, the trip will be on schedule time, so that all of you will want to keep one eye on the leader, so that you will not get left in some far off part of the trip, and have to find your own way home. Those are important things, because we will tie up the Mineral Railway with travel all the time we are on the trip, and it wll be necessary for us to travel on time—on the time they have fixed for us, and so please remember that is the schedule time for the trip, and we will have to follow strictly the schedule. The ladies, of course, are welcome on both these trips. Tomorrow we will favored with an old time Southern barbecue by the Waterworks Company at their plant on the mountain, and that will be our entertainment for the day. On Thursday we will be served with a light lunch on the train between our stopping points, so please don't forget to bring the ladies for both trips. Now there is one place which will be missed on both these trips, and that is the sewerage purification plant, and as I understand it, the plant is not yet completed; the sceptic tanks are completed and in working order and in operation, but the filters are not completed—or constructed, and I do not think any steps have been taken to construct them yet. If there are any of you who would like to visit the septic tanks you will hand your name to the Secretary, Mr. Tillson, and he will arrange for a special trip to that locality, which is pretty well below the city. They have been obliged, for reasons we need not discuss, to carry the outflow considerably further down stream than they thought was really necessary, and they have taken advantage of that fact to put in or at least provide for a gravity system of disposal, so that the sewerage at the present time empties into the septic tank, and will eventually empty in the filter plants. It will take too much time and will be too much of a trip for us to leave the train and go to see it, and therefore it will be necessary for those who would like to see it, to arrange with Mr. Kendrick for a special trip, who will be very glad to arrange a trip for as many of you that want to go. I think this is all for this afternoon, and we will now adjourn until 8 P. M.

8:00 P. M., TUESDAY, OCTOBER 9.

The President: Gentlemen, if you will come to order we will start the programme, but we are a little bit late. The first paper on the programme this evening is on "The Municipal Control of Planting and Care of Shade Trees," by Mr. William Solotaroff, of East Orange, N. J. Mr. Reimer will read his paper.

Mr. Reimer: Mr. President and Gentlemen of the Convention: If you will allow me to preface the reading of this paper by a little of my own experience I will do so. I have been in charge of the streets and sewers of East Orange for eleven years and for seven of those years it came under my part of the business to see that the trees were taken care of, and much trimming had to be done. I was continually an advocate for the city's control of the trees, the planting of the trees and care by the city, but the only care they got during those seven or eight years was such as we could give to them by trimming and cutting out the dead wood and getting clear of the debris. That was done pretty quickly, but we had no authority to plant trees, and there was only one set of trees which ordinance provided against, and that was poplars, and such trees as the Alianthus.

Our state within the last three years passed a law whereby municipalities might provide a shade tree commission, and I was very much pleased to have our city take it up and such a commission has been appointed. An expert has been provided who looks after the trees and I pursuaded him to write this paper for the convention.

THE MUNICIPAL CONTROL OF THE PLANTING AND CARE OF SHADE TREES.

BY WILLIAM SOLOTAROFF, SECRETARY AND SUPERINTENDENT SHADE TREE COMMISSION, EAST ORANGE, N. J.

The importance of having the streets of our cities well shaded with handsome trees is not questioned by anyone. A street which has its sidewalks lined with trees is always an attractive feature in any town of whatever size. Two purposes are thus served, one is sanitary, the other esthetic. From the viewpoint of health we need but recall a few well known facts. Trees help to purify the air by absorbing carbonic acid gas that is exhaled by man and giving back the pure oxygen he needs. Trees also help to modify the temperature of our streets. The normal heat of summer is still further intensified in cities by the reflections from the pavements and from the buildings. It is then that the benefits of the shadows cast by the foliage of the trees is best appreciated. The esthetic value of shade trees is very great. No city in America possesses such avenues of fine shade trees as the City of Washington. The trees of that place are held in higher estimation than architectural display, and while visitors admire the fine public buildings, everyone will admit that the chief attractions of Washington are the beautiful avenues of shade trees which make it one magnificent park. The task of planting trees on the streets of our cities and the problem of taking care of those already existing are matters of vital importance to all those who are interested in municipal improvements. The advisability of planting shade trees on the public highways is readily admitted. The only question that concerns us is one of method. How should this planting be done, and what system will assure us the best results?

In every city of the country where trees are most abundant and where they are most likely to thrive, at one time or other there arises the problem of taking care of those trees and of setting out new ones. There comes a time when a certain species of tree is attacked by an insect, when the trees along a certain street need pruning, when trees are to be guarded from horse bites and passing vehicles; or when it is desirable to plant a newly opened street. At the very writing of this paper, I received a letter from a citizen of Elmira, N. Y., stating that he had been requested by the mayor of that city to devise a plan for pruning, repairing and taking general care of the trees of that city. He asked for suggestions in the matter of organization and methods of work.

There are two ways by which the work of planting and caring for shade trees can be accomplished. The work must be done either by individual land owners or public officials. The prevailing policy of most of our cities has been to leave this task to the individuals who own the property on a certain street. The results thus obtained have been very unsatisfactory. There are no two people governed by the same taste in the choice of trees for planting, and as a result we usually find more than half a dozen different kinds of trees on the same street, undesirable species mixed with desirable, set either too close or too far apart and left unprotected from injury. In one case the trees will not be trimmed at all and the limbs will be so low as to touch the head of the pedestrian: the neighbors' trees on the other hand will be pruned too high. A concrete example of the conditions as to shade trees on a street in East Orange, N. J., will illustrate the results accomplished by individual planting.

There are forty-five trees on this street. Of these there are seven white maples, seven horse chestnuts, eleven red maples, two American elms, eleven Norway maples, three sugar maples, one ash-leaved maple, two poplars and one linden. The trees range in size from two inches to thirty inches in diameter, and their distances on the street vary from 18 feet to 282 feet apart. Twenty-nine of these trees are rated good, seven are medium and nine are bad. Now what beauty can a street possess on which there are nine species of trees in all sorts of conditions, and widely varying in shape and size. The street described above is not an exceptional one, but is rather typical of the streets where private planting has been the the rule, and familiarity with the condition of the shade trees in many of the cities of the State of New Jersey makes it safe to say that what is true of one state will be true of another, and that the results accomplished by individual planting have been very unsatisfactory.

When there comes a time that a certain insect pest is to be combatted and the work is then left to the individual citizen to do, he is completely powerless to accomplish anything. He may plant an undesirable species of tree if the task is left to him, but in insect fighting he will do even less. His efforts will come to naught if his neighbor allows the pest to remain on his trees. In the extermination of insects in a city, it is absolutely necessary that all the infested trees be treated in order to obtain effective results. The insects spread very rapidly: in fact, it is even difficult for a city that has an organized system and apparatus for spraying trees to keep the trees entirely free after treatment if the neighboring cities do not check the spread of the pests. It is impossible to have concerted action on the part of thousands of people of a community in the treatment of infested trees at the same time. Insect fighting requires persistence and a knowledge of what to do at the proper time to obtain results. There is a period in the life history of every one of our tree pests when it may be most easily destroyed. This stage is not always at the time when the most injury is apparent, or when the average citizen wakes up to the necessity of doing something. The life history of the pests must be known in order that treatment may be given at the right time. The injury to trees by borers is a case in point. The foliage does not show the effects of the damage done nor do the limbs begin to die until three or four years after the caterpillars of the borers did their fatal work. Then the people wonder why the trees are dying. Hundreds of fine sugar maples are dying every year in the northern section of the State of New Jersey, as a result of the ravages of the borers a few years ago. Attention to them at the time the insects were active would have saved the trees.

How little a citizen can do is shown by the condition of the private grounds and orchards in any city, even where there are organized bodies to take care of the shade trees. On almost all the trees on private land are found borers, aphids or plant lice, and a great abundance of scale and sucking insects. They remain and propagate from year to year, and if one man by persistent work succeeds in ridding his place of the pest one year, the next year his garden will be as bad again by the migration of insects from his neighbors' grounds.

We cannot blame the individual for these unsatisfactory results. We are seeking in regard to shade trees, at least, that which is for the common good of all, and we expect the work to be done by the citizens without instruction, without system, and leave to each one, if it so pleases him, to do his share when and how he pleases. It is the system that is wrong, and the remedy can readily suggest itself. Other municipal interests are vested in commissions, committees, or other organized bodies. It is felt that the matter of planting and caring for shade trees should be entrusted to a similar body and a shade tree commission should be incorporated in every municipality.

The idea of placing shade trees under the control of an organized body is not new and the results accomplished in cities by such provision have been so satisfactory that it seems surprising the system of municipal control is not becoming more general. All the trees in Washington are cared for by the city and all planting is done by city authorities. The new charter of Greater New York placed the shade trees under the care of the Park Department. The work done by that department, especially in the Boroughs of Brooklyn and Queens, has improved the condition of the trees very materially. The jurisdiction of the Park Department of New York extends only to the existing trees, and there are certain ordinances governing the setting out of trees by individuals. It has not the power, however, of initiative in setting out new trees either by a general appropriation or putting a lien on property the same as for any other improvement. The best solution, by far, of the problem of the planting and care of shade trees is provided by a law of the State of New Jersey, and as far as we know, it is the only law of its kind in any state in the Union.

An act of the laws of 1893 of the State of New Jersey provides for the establishing of commissions to take charge of the planting and care of shade trees on the highways of the municipalities of the state. These commissions are to be composed of three members, appointed for terms of three, four and five years, and are to serve without pay. It is optional with the governing body of any city whether this act shall have effect there. New Jersey, Newark, Passaic, East Orange and South

Orange are among the places that have availed themselves of the privileges of this act. All matters pertaining to shade trees in these places have been placed in the hands of the respective commissions. All work is carried on in a systematic way, and all trees are planted, pruned, sprayed and removed under the commissioners' direction. As practically operated, the commissioners serve as an organization, and they employ a professional man who has full charge of the executive work. Wherein these commissions differ from other similar bodies is that they have the power of initiative in the matter of planting. They decide that a certain street is to be planted and determine on the species of tree. An advertisement of the intention to plant is inserted for two weeks in the public newspapers. After the work is done the commissioners meet and certify a list to the receiver of taxes on which is given the names of the owners in front of whose property trees were set out and the cost of the work. This assessment is entered by the receiver of taxes on the annual tax bill and is paid the same as any other legal lien. The cost of pruning, spraying, removing dead trees and repairing old ones is provided by a general appropriation.

A brief review of the work done in East Orange, N. J., during the two and a half years that the Shade Tree Commission has been in organization will give an idea what has been done in all the cities of the state where the tree commissions have been established. About 1,300 trees were planted. The species chosen were the Norway maple, the sugar maple, the European linden, the American linden, the pin oak and the Oriental plane. Only one species of tree was planted on a street. These were set out at uniform distances apart and all trees were supplied with uniform wire guards. The advantages of such a system of planting can be readily seen. By selecting the proper species of tree for street use, hardy trees are taken of symmetrical habit, of well filled head, neither too open nor too compact. By placing the trees at proper distances apart, each tree is allowed to develop its characteristic beauty and when mature there is sufficient space between the outstretching limbs for the admission of light and the free circulation of air, so essential to health and comfort. Streets that have become famous for their beautiful shade trees, both in this country and abroad, are planted with one species of tree. This plan is followed in Washington, and the fame of Flushing, Long Island, as a beautiful suburb, is due to the fact that its fine streets are in the majority of cases planted with one variety. Setting out one species of tree on a street can be done only when one man or one body is laying out the work. An organized body in planting a street treats it as a unit, and selects a tree that is best adapted for the width of street, condition of soil and nearness of the houses to the street. By placing guards around all trees when they are set out, all injury from horse bites is prevented.

There are sixty-seven miles of streets in East Orange. The trees on about twenty-eight miles of those streets were pruned under the direction of the Shade Tree Commission. In this work, too, the street was treated as a unit. All trees were pruned to a uniform height, a height that would permit the unimpeded passage of vehicles and would allow all street lights to be seen at night. All scars were painted with coal tar to help in the healing of the wounds.

By far the most important work done by the Shade Tree Commission of East Orange was the successful combatting of the insect pests among which were the tussock moth, attacking the American elm, the horse-chestnut, the white maple and the lindens; the cottony maple scale attacking the white maple, the wooly maple scale attacking the sugar maple, and the elm leaf beetle attacking the elms. As far as was possible, the idea constantly borne in mind was to fight the insects before they developed, and hence before great damage was done.

The placing of the control of shade trees in the hands of commissions is no longer a theory in the State of New Jersey. Those cities that have availed themselves of the privileges of the state act and have organized the commissions, are enjoying the benefits of the work of these bodies and other cities are taking up the matter. Considered solely from an economical standpoint this system of municipal control should commend itself to all interested in city improvements. A body planting several hundred trees at one time is able to select good nursery stock, get the trees at wholesale prices and accomplish work which the individual could not do at perhaps twice the price. The result is that there is no opposition on the part of the citizens to the improvements which the commissions in the several cities of New Jersey are making. The advantages of their methods are seen and assessments for newly planted trees are paid as readily as for any other improvements. The desirability of having shade trees, especially on residential streets, is now universally recognized. From all large cities people are flocking to the suburbs, and the desire to make these places as countrylike as possible is very great. Real estate people are aware that beautiful trees will increase the value of their property. Either through ignorance, however, or more likely through the desire for immediate effect—real estate people build houses to sell—they are planting the Carolina poplar and the soft maple to the exclusion of every good tree. Any one familiar with the new sections on Long Island, in the Boroughs of Brooklyn and Queens, developed by real estate firms, will understand what is meant. The Carolina poplar is the predominating species of tree planted. In a few years these trees will detract rather than add to the beauty of the places. As in the setting out of trees, the future rather than the present is to be considered, the importance of the question of shade trees in new cities is just as great as in those having old trees; and a body to take charge of trees should be established in every city as soon as the streets are opened and provisions are made for any other city improvements.

THE PRESIDENT: You have heard the paper and it is now open for discussion. It is a very important question and I would be very glad to hear some expressions regarding it.

Mr. Weissleder: It strikes me that the methods described in the paper just read is one almost any municipality might establish, and there is scarcely a city in the United States or Canada that could not establish that method, because it is one that is simple in its entirety and could be of universal adaptability. The paper is certainly a good one and I have experienced some of the points the reader set forth; he mentioned some of the trees that are obnoxious, mentions the Carolina poplars. I live in Ohio and have some of them on my property and they are a miserable tree, and we had two of them blown down by a storm and we planted maples in their stead, and wish we had more of them destroyed in that same way.

The President: I might say something about our method in Indianapolis. It don't go far enough. Some years ago we had the question of the control of the street trees under discussion, and finally had a law passed by the legislature creating the position of City Forester and the planting and trimming and taking out of all trees in the streets of the city and public places was put in the hands of this forester. The park board had the appointment of the forester and the park superintendent has always held the position. Theoretically it is a very good proposition, but practically it has not amounted to very much, because the park superintendent has always felt that he did not have assistance enough and did not have money enough to perform that duty in addition to the regular park work, which has always been very slow on account of the lack of appropriations, and they have had so much other work to do that they had not taken very much care of this particular thing. But practically it has reduced itself simply to the matter of issuing permits for trimming trees. My next door neighbor, for example, has two of the Carolina poplars and his next door neighbor has one of them, and he has between his two a couple of very little maples and I have been after him to get out those two Carolina poplars, but I have not been able to get him to do it yet. If we had a shade tree commission, or if the city forester would attend to his duty, we would soon have those two trees out. My friend seems to want them out, but is afraid to do it. I happen to be the president of our local Civic Improvement Association and we have recently had brought to us a case that may be of interest and some may have something to say about it. We all have difficulty with the linemen of the different telephone and telegraph companes trimming trees they have no business to touch. We had a very flagrant case of that three or four weeks ago, where they went on private property belonging to two colleges and took out two very beautiful elm trees and practically destroyed two others, and we have been trying to place the responsibility for that damage. The universities' friends have brought suit against the linemen who did the business, but I don't know how much they can ever get out of them for it, and the matter was referred to our Civic Improvement Association. I came across a paper which had been written by a lawyer for the Iowa State Association in which he went into the question of the ownership of the trees in the streets, and he finally decided that the property owners actually own the trees, but they have not very much to do with them; that the city has control of them; that the city can do anything it likes with the trees within reason and that this entire matter ought to be taken in charge by the city. I believe there was one case in which the city was sued and a judgment was obtained because it had cut down a couple of very beautiful trees in front of the property of a certain tax payer, and that showed that the city didn't have complete control, that is, it could not remove a tree which belonged to a property owner, but it could regulate it. We took up the question of the responsibility for the damage to trees in the street. It is usual for the proprietor of the telegraph line, or telephone line, to say that he has issued orders to his employes not to trim the trees, and, therefore, the company is not responsible for the damages done. It didn't seem to me that that was very good law; it certainly is not very good sense. Why, they say to their employes they are not to trim the trees, at the same time they give them imperative orders to put the line through and not have it interfered with by anything on the street. The two orders are entirely at war with each other and one of them has to give way. Of course the one gives way which the employe finds the least trouble with. Consequently he goes ahead and trims the trees any way he likes, and in our latest case it took an axe to bring him out of the tree and a good strong man behind it who threatened to knock him out of the tree. Our present proposition is to bring suit against the telephone company itself for damages to the trees. If we can succeed in this we think we are in pretty good shape to take care of the trees. Of course we will have the responsibility for the damages definitely placed, and we have a responsible head who has charge of the trees, and if we can only make him do his duty we are satisfied we can take care of our trees in very good shape. I think the plan which is in use in New Jersey is excellent, and in practice I presume it works out better than our own proposition, because they have at least a public spirited commission which takes care of the work that is given to it. We have a municipal official who is loaded up with the duty additional to the duties he already has and is not given additional assistance and additional money to take care of his new duties, and he neglects it. That is the advantage of the New Jersey system over ours.

Mr. Weissleder: I might remark that while I had charge of matter in Cincinnati the limbs hung very low. I referred the matter to the corporation counsel and explained the situation and he made a ruling that it was proper for the authority having charge of the matter to attend to it. If any obstruction appeared on the street we had a right to have it removed. We gave instructions to the gas company to trim the trees to a 12-foot zone. Where there was a light the center trees didn't offer any obstruction, but those in the immediate vicinity of lamps were trimmed. The wires carrying the currents for such lamps had injured a number of trees, and property owners protested and came to my office and said they were going to sue the gas company for damages for damaging the trees. I advised the people that the case would not stand the test of the law, because the function of the board was to light the street and that it was carried on by means of electricity and if they run through the trees and the owners didn't permit them to trim the trees they would be damaged, and I advised them to let the trees be trimmed, consequently we had no more trouble. In the matter of commercial wires, that was another thing, and I advised that they arrange that satisfactory to themselves. When it come to commercial wires they had no authority so far as trimming trees was concerned; in one case it was a public duty and in the other it was a private enterprise. These members will understand the difference. I advised everybody to permit the trimming when it is properly done, and not do as the gas company did in one case. The man wanted to cut the dog's tail off, but cut it off close behind his ears. They cut them down so low the gas company had to pay a large sum of money, so I was informed.

MR. CHRISTY: I don't know whether the Convention would care to hear anything in regard to our tree business, but I rather think our little city has been in advance of many others in regard to caring for their trees. One of the features that came under my control were the trees for a good many years. There are laws provided that no one should do any damage to any trees on the street. If we discoveerd that any telephone or electric light company or trolley line were mutilating the trees we haled them to court. We stopped that business very quickly. In other instances where they chose to brace their lines up by putting wires around the trees, a notice was sent to the offending companies that the wires must be removed and if they did not they were notified if they did not remove them in a certain number of hours they would be taken out, and that generally brought them to terms. We were in pretty good shape so far as law is concerned, to handle them, so had little difficulty. The chief difficulty and one that we found a good deal of trouble in removing was where large feed wires had been drawn through the trees. While the companies would protect their main cables with wood shields, as the tree was swayed, the bark would be rubbed off and we got them to put the protection on the tree instead of the wire, but a good many of our trees were seriously damaged. There is one item in that paper on which there might be some question raised ,and I would like to ask how the tree commissioner has gone to work. Mr. Solotaroff has stated that by the buying of a large number of trees and planting them the work could be done cheaper than by the individual owner. At first sight it would appear absolutely false that the cost of planting our trees would be more than the ordinary owner would pay. The commissioner has made a ruling that the tree should be planted in good soil, and if it is not good they excavate a hole and fill it with good soil and plant the tree in that. Ordinarily the citizen don't do that; he hires a man to stick it in and that is the end of it. Our plan has been entirely different from that and our trees are growing very fine, but they cost a good deal more than $1.50 or $2; the average price is perhaps $5 a tree, but the method in planting assures success.

A Member: Does $5 a tree include the protection?

Mr. Christy: The protection costs about 60 cents, a wire with a mesh around the tree about six feet high. So far we are well pleased with the work. It is doing very good work and we are satisfied today that it is going to be all right.

Mr. Hatton: Mr. President, that paper appeals to me very much. It is a new idea to me and it looks to me that it ought to appeal at once to a large number of municipalities. I know how it is in our city with which I was connected for a good many years. We had all these tree troubles that the paper speaks of and which these other gentlemen speak of. Our city is a city like East Orange and other cities of Northern New Jersey and the streets are full of trees. There is one point in that paper which particularly struck me, and that is the distance which trees are planted if left to private thought. For instance, there are many illustrations and I think every member here who is interested in cities will find that that is true. If a man has a lot 25 feet front, one tree is not enough for him and he plants two trees in that 25-foot front, perhaps the greatest distance is twelve or fifteen feet apart, and the next man wants to do the same thing and plants two trees, and that has occurred all over our city until the trees are dwarfed because they have not had sufficient room, one side is flat and the other side is round. This idea of municipal control over the planting and trimming is a splendid idea. I am glad to hear it read.

MR. CHRISTY: Mr. Hatton touched upon the idea about the man planting two trees. He not only had the trouble of making the space too small, but there comes along another man five years afterwards when those two trees planted have a fair growth and he wants to catch up with the first one, and so plants a couple of lombardy poplars, and that is the way it goes. Here we have a couple of maples with hardly room enough for one good tree to grow. Our great trouble with them is the condition in which they leave the sidewalk. It has been necessary for our board in the last year to hire special inspectors to go over the town on account of the bad sidewalks caused by these poplar trees. About two years ago they adopted an ordinance preventing the planting of any more of them. The people are beginning to appreciate that they are a bad thing, but the reason they were put in was to save time. They have also had a great deal of trouble with them; they seem to hunt water. We have had half a dozen cases this year where sewers had to be taken up to get the roots out, which would be entirely filled, and it seems to me the first thing a city wants to do is to regulate the tree end of it. So far as the cutting by the wires of the electric company is concerned I think we have had as much of that trouble as any city in the country. One of our directors was away a couple of weeks and had a couple of nice trees. Before he went away the electric company said they would like to do a little trimming and he gave them permission, thinking that they would use some judgment, and when he came back he said he didn't know the trees, was not quite sure whether he was at his own home or not. But they have started in trying to control the wiring companies by making them use a very high pole so that they will try to clear the best part of the trees anyhow.

MR. WEISSLEDER: I want to make a suggestion to some of the members who reside in cities large enough to support a newspaper with large circulation, to go to work and have the newspaper solicit funds, as was done by the Tribune in Cincinnati ten or twelve years ago to plant trees on Gilbert avenue, which was built by cutting a shaft on the hillside. The Commercial Tribune raised enough money by popular subscription to plant trees and provide each tree with a wire tree box, but I suppose the Convention will not agree with the forester when I tell them that all these trees were unfortunately poplars, because they were quick growers and afforded shade in a very short time. So if anybody has a newspaper that they want to give them a pointer to do with, that would be a very good idea.

Mr. Reimer: I might say that the average distance apart we are planting our trees is 35 feet. I would like them a little wider apart, but 35 feet is a fair distance and any of the maples will cover that space when fairly grown very nicely and not run a chance of destroying the top of the tree.

Mr. Hatton: You don't vary that distance according to the kind of tree?

Mr. Reimer: Slightly so, but the average distance is 35 feet.

Mr. Weissleder: What will a man do who has a neighbor with 25 feet?

The President: We have lots on our street which are about 40 feet wide and we have a little grass patch in front of the house, which, inculding the width of the sidewalk, would permit us to set three trees and have them 35 feet part and still not up too close to the house by setting them in a triangle. If the setting out of trees inside of the lot as well as outside enhances the city property we can give each man three trees, and have two rows of trees the whole length of the street. But if we don't have some control that way we are liable to throw two trees in front of each lot and crowd them. I have two trees in my lot and one on the sidewalk, my next door neighbor would have two trees on the sidewalk and one in the lot.

Mr. Hatton: I would like to ask the speaker just one thing: You say you plant them about thirty-five feet apart, now suppose those lots are 25-foot lots, every man cannot get a tree on his lot, but you assess the cost of that as a whole?

Mr. Reimer: I believe that is the case.

Mr. Christy: And he gets the telegraph pole, don't he? (Laughter.)

The Secretary: Mr. President, some reference was made in the paper to the park commissioner in the City of New York having control over the trees. He does have control to the extent that when the bureau of highways improves the streets, if any tree is in the way, and has to be cut down, the park commissioner must give his consent to the removal of that tree before it can be touched. That might cause some trouble if the two departments did not work in harmony, but at the present time we think they harmonize very well. While it takes some red tape and takes time, still I think the results justify the extra work. There was one statement in the paper that might be right in the abstract, but it would create a wrong impression. If I remember right the paper stated that the park department had no right to put out new trees.

Mr. Reimer: On streets?

The Secretary: That is not so; they have not a right to put out trees and makes an assessment for payment, but so far as their appropriation will allow them, they do have the right to set out trees. A notable instance of that was two years ago when we improved Fourth avenue, a street which was paved with asphalt for about four miles. For the greater portion the roadway is 70 feet wide, a park 20 feet wide in the center, and 25-foot roadways on each side. The park department treated it in this way: They took the first mile and set out maple trees along the curb and on both sides of the park in the center; the next mile was treated with elms, and the third mile with oaks, the idea being to give uniformity and at the same time variety. Of course, if you have a mile of the street of the same kind of trees you get uniformity, and if you have a street three miles long and have three varieties, you get variety. Unfortunately a great many of the trees died, although they were set out carefully and top soil was put with the trees. Of one variety almost every individual tree died.

MR. REIMER: The oaks most likely.

THE SECRETARY: I am not positive. The park department has complete control over the pruning and trimming and no individual or corporation can trim any tree without getting permission from the park department.

MR. HATTON: Or plant any tree?

THE SECRETARY: No, sir. The question of who has jurisdiction over the trees depends on what the city's rights are in the streets. When Brooklyn was a city by itself, and a street was opened, the actual title was not taken, but only an easement for street purposes. Now the courts have decided that does not give the city exclusive ownership of the trees, but since consolidation, the acquirements of all streets has included the absolute title to the street itself for whatever purpose used, consequently the city has complete control over the streets from property line to property line in any street that has been acquired since Jan. 1, 1898. We had an instance the other day where the park department had given some one moving a house the privilege to trim some trees in the street. A property owner was somewhat unfavorably disposed toward the proceeding and went into court and stopped it. How it has finally been settled, I do not know. But this was on a street that had been acquired by the city before consolidation and the city did not have absolute title to the street. I appreciate very fully the action of the real estate owners referred to in the paper and also some of the others in planting Carolina poplars. That has been done to a great extent in Brooklyn, and for the time that they have been planted they certainly give first class results. They make a pretty tree, grow rapidly and improve the street very quickly, and while I never thought they were very desirable trees, I did not suppose they were as undesirable as many of the speakers state. It is practically impossible for the city to control that phase of the subject for this reason. We have in Brooklyn a situation which I never have seen elsewhere, and that is a great many of the streets are built upon and improved before the city has any title to the street at all, and until the city has the title to the street, of course, they can have no control over it, and in that way they plant whatever trees they please, and as they please. It is a fact that on our petitions for new improvements in the outlying sections of the city that out of the streets asked for to be improved fully one-half are not open streets technically, although in many cases they have houses built upon them, some as long as fifteen or twenty years. In that case the matter is taken up and examined by an engineer and a statement made as to the condition of the street, and this statement is submitted to the corporation counsel and he examines the conditions personally and then decides whether in his judgment he thinks it is safe for the city to go ahead and make an improvement on that street. The importance of it is that all of our early improvements, including grading and curbing, is paid for by the property owner, and if the city should improve a street and the courts decide it had not sufficient title it could not collect the assessment, and the city would have to foot the bill.

Mr. Weissleder: In speaking about the obstruction and improvement of the streets, what obtains in our city is about as follows: The resolution to improve emanates in the council of the leading body which designates the width of the street. If there are any trees there the trees suffer, and in one case a street was improved that had old silver poplars on it for a distance of nearly two miles, and they cut down every single tree. It was a toll road and was acquired by the city and had a line of street cars on it, and the street car tracks were laid close to the trees and the middle of the roadway was used as a speedway, and, of course, in the improvement of the street the street car tracks were put in the middle and every single tree, or nearly two miles of trees, were removed and no trees planted in their stead, and, of course, there is something that is missing, viz.: the shade, but being almost exclusively a manufacturing district, the absence of the trees have not caused much suffering, because the factories want all the light they can get. The power rests in the board of public service.

Recently a case came up where the property owners protested, because the street was to be paved with brick, and the question came up why they could not narrow the roadway. One-fifth of the street is set apart for sidewalks, and the street is set according to that rule and the result is that the tree is generally cut down. to set the curb but sometimes the tree will be sitting with a shoulder on the curb and after a while the hubs of wheels finish the tree and it dies.

Mr. Parkes: If it is necessary to cut down the tree we had better move the street. I am speaking from a little experience on that line. You can build a street in about thirty days and you cannot grow a tree in thirty days to save your life. I have been out in the woods, but I have been building some brick streets, and we have some beautiful trees. They are sycamores and they are the worst trees in the country to shed their leaves. But I will tell you right now a tree is the dearest possession that a property owner has; he will fight for it until the last breath and be taken into court on it, and he ought to, and if he can beat you he ought to do it, because you can put everything back there but that tree; money won't buy a tree. If you can build your street around that tree, built it around it; if you cannot build your sidewalk up—I built one. I have got sidewalks right there, gentlemen, that are three feet above my curb grade, and I have got a pretty good grade on that street, and my sidewalks are above that. Why, not because I believe it is a good idea for the sidewalk to be three feet above the curb, but because I believe the tree improvements more to a man than six inches of roadway, and when you can save a man's tree by moving a little to one side, why, move to the side and save the tree.

Mr. Weissleder: I agree with the speaker that the tree is a precious possession; nobody denies that, but when you come to measure the necessity of the case the matter of a mere tree ought to have but litte weight. In building the sidewalk I understood him to say he built the sidewalks higher. What could the city's rights be if a pedestrian fell and injured himself? The man would have a claim against the city that permittted the sidewalks to be built dangerously. Nobody would deny that claim. The city is liable, and therefore the city is bound to protect the public, and build its sidewalks and streets so that they can be used safely by pedestrians; the matter of trees is largely a matter of sentiment; the safety of the public comes first, but the other considerations may follow. Of course, save trees where you can, but cut them out where it is necessary to establish a curb line. I know of a place where a sidewalk was built around a tree, and when the suburb was annexed we had those conditions to contend with. It is a nuisance, and on a dark night a person is liable to run into it and the matter of a tree should not enter into the matter of giving the public proper walks to walk on.

THE SECRETARY: We do everything we can to preserve the tree. We have an ordinance, for instance, on a sixty-foot street, making the roadway thirty feet. I had a case sometime ago where to put the street at the regular grade and curb line would have destroyed the trees on each side of the street; we changed the roadway and grade. We raised the grade and brought it so near the top of the ground so much so that it was not necessary to disturb the trees. In regard to the building of sidewalks above the streets, in New York this would get us into complications, because all that kind of work is assessment work, and if the street is not carried out according to grade the property owner could dispute his assessment, and the engineer would get into trouble with the law department. There is another trouble. A property owner owns perhaps a hundred feet on the street, and asks that his sidewalk be left above the street. Then suppose after the assessment is made, he sells that property and the new owner comes in and says he wants that property cut down to the curb grade, the city would have to do it, and pay for it out of the repair fund.

MR. HATTON: Take it out of the engineer's salary.

THE SECRETARY: No, sir. Where the work is done by assessment proceedings, you have to be very careful, and do a great many things which you would say was not common sense, but really the engineer cannot take any chances.

Mr. Parkes: What I desired to say was simply this, as I said a few moments ago, we don't all work in New York, and I work where laws are different from yours, entirely different. The assessment proposition is not local with us. The city cannot make an improvement in my state at all. It is done by the property owners themselves. There is no way on earth that a man in our town can make the city lay his sidewalks. What we could do or what we could not do about a grade was not what I rose to speak of at all, but a tree is the most valuable possession a man can put upon his place. It is not a question of a man's falling over himself; if he wants to fall over a tree let him fall over it; and if he wants to fall over a fence, let him fall over a wire fence. I have got a sidewalk two and a half by three feet high, and it is not hard for an intelligent man to walk that. It don't require any special intelligence to do that, a sidewalk is an easy grade and he can do it. The other day I went up against this proposition: I sent my assistant out to stake a sidewalk, and he came back and said the man has got a shot gun after us, and we cannot lay that sidewalk, and I said why, and he said "You will cut down a tree." They were laying a five-foot sidewalk, and a tree in the middle of it. What are we going to do with it? Cut it down? I didn't. Spread it out two and a half feet and go around the three, and if the brother don't know the way to get around that tree when he goes home, I have got a police force over there to kindly take him by it.

The Secretary: I did the same thing as that myself, although I made the walk over two and a half feet, about four feet on each side, and the owner of the property was glad enough to pay for that extra walk to have the tree preserved, but there is one thing the gentleman don't think of. We have men in New York who are not very intelligent when they go home, and if they knew there was any danger on that sidewalk and that sidewalk has not been put to grade properly, the man would have a valid claim against the city, and could collect it, and I would get a very strong call down for allowing the street to be built that way.

MR. WEISSLEDER: I am a little surprised that Brother Tillson speaks of the inability of the engineer in grading the sidewalk. That is a thing that I am nonplussed over, for the engineer is certainly the mechanic in charge of the work and he ought to establish the level of the sidewalk in that particular locality. We are in a small town in the interior and do things probably different from the way they do in the Metropolis of New York, but if a property-holder in grading a street suffers any damage by changing the altitude of the sidewalk, and he has to walk four steps in lieu of one or two, he is paid and it comes out of the appropriation to improve the street. There have been many retaining walls built in Cincinnati as high as twenty feet, where a mountain was cut down to change the grade, to better property conditions, and the man who butts on that property gets damages, but what has he got to do? He has some physical labor to get up and down to his house, and that cannot be expressed in dollars and cents alone.

THE PRESIDENT: Perhaps we are getting a little off the subject, and this matter has been gone over pretty thoroughly already, and as we have two papers yet to read, we will go on. Mr. Crandall, of the Committee on Taxation, has not arrived, so we will pastpone that until he arrives. The next is the report of the Committee on Municipal Franchises, by Mr. Weissleder.

MR. WEISSLEDER: Mr. Chairman, in appointing that committee you no doubt felt that you had material from which to select those to be entrusted with that work, but I must confess that owing to the illness of Mr. Barrow, and Mr. Rust's absence in Europe, a great deal of the time, I have a good notion to let Mr. Rust read the memorandum I have prepared. It is hardly to be called a paper, but simply a sketch outline of some thoughts, and this convention can take it up and discuss it, and see if we cannot get more trees planted along the line of progress. We all no doubt have had experience with franchises, some in participating in some of the benefits that flow from their possession, and some perhaps in construing the rights of the grants, so I beg the indulgence of my hearers in presenting this paper or rather what is called as such:

MUNICIPAL FRANCHISES.

BY L. H. WEISSLEDER, CINCINNATI, O.

I beg the indulgence of my hearers in presenting this paper, or rather what is offered as such, as the subject can be viewed from several angles, and the one I have chosen will, I believe, be new to some who have probably not witnessed as we say "Trying Times," in the struggle for existence by some individual or corporation that had accepted an "Abstract" franchise grant and tried to convert it into a "Concrete dollar; who has not seen wrecked fortunes and hopes along the highways or financial public service endeavor."

The possession of a franchise granted by any municipal legislative body to permit corporations or individuals under statutory authority to engage in any business in which all or part of said business plant must be erected and operated along public thoroughfares or other public places, presents several aspects as to its value:

1. Dependent on its tenure of life.
2. The conditions as to amount of money paid to the municipality for all or part of its life (called for convenience a franchise tax) or its equivalent in services, conveniences and benefits dependent on the nature of the business carried on. If such franchise can be curtailed or nullified in an arbitrary manner when certain stipulations are embraced in the original grant, that may be construed by different legal minds to have opposite meanings in which case the trials, tribulations and anxious moments of the public utility man certainly obtains, as the public is usually taking sides on these questions fostered often by a sensational press which seeks to spread ink on large type rather than to fairly lay the issue before its readers. As considerations of equity do not always enter deeply in this discussion by one side of the public (and sometimes the press) there is always the danger of unfair moves (through public clamor) by the hostile interests, that may partake of either a political or sectarian character, and sometimes neither, but rather a battle of financial giants with the public, however, still taking sides without a single sign of benefit or gain in any way; but just because the public "dearly loves a fight." These contests, however, often leave an unhealthy aftermath in the community in that it is apt to create the feeling that a victory no matter by what means it is won, is a thing to rejoice over, thus blunting the sense of right and justice, and the members of this assembly are perhaps only too well aware how near home there stands recorded some of these happenings, either in a mild form, or probably in a serious and almost revolutionary degree.

Let us look at the question from the standpoint of an unbiased observer. Suppose a corporation that is properly chartered and amply financed and in the possession of a grant to carry on certain public utilities within the corporate limits of a city of, say, 300,000 inhabitants. The municipal franchise being duly granted under the laws of the state in which said city is located. The corporation having complied with all the statutes covering its operations, carried out all of its local franchise obligations in every year of its existence and in every other way, has properly conducted its' business, and whose rights were never questioned; meeting the public demands from time to time as occasion indicated. Now, by this standard of performance we measure the rights of this corporation as being superior to the assumed or alleged rights of a group of men who make a great display of professed love for the "public," who are "being robbed" by said corporation, that it is attempted to supersede by appeals to the public through the press and to the legislative body having the power to grant privileges, that if this group of men are only given a franchise to engage in the business, that the corporation above cited is conducting, that unlimited benefits would follow such action. Now, the unbiased observer would naturally ask what are the reasons prompting these men to want a franchise that would involve the construction of an entire and complete physical plant of like character operated by the corporation they covet to rival by competition, when if they desire to earn money on an investment, why they don't invest in the stock of the "Going concern," and thus save themselves time required by construction and the necessarily long period after starting up to have an income representing a fair return on the investment. The answer is,—well, you all know, and it is not given here as it is *obvious*.

If, however, a corporation, as per example, the one cited herein, defaults in any material obligation of its franchise and refuses or neglects to repair any such breach of contract when demand is made so to do by the properly constituted authority, and an aroused public demands that either a full compliance with its charter and grant be vouchsafed, the grantors, or, else the franchise will be annulled, also makes the answer easy when the question of right and equity is propounded.

The public is not averse to maintaining the integrity and permanency of a grant if good faith is shown by the grantee. There are times, however, when the grantee appears delinquent for want of a thorough knowledge of all the facts in the case, as very few, if any grantees would knowingly or wilfully impair their standing or jeopardize their rights, and when this disposition is quite manifest strong and unmistakable public sentiment should support the grantee in the enjoyment of its privileges. A proper respect for vested rights is due the grantee, when its business is conducted along the lines of honorable commercial dealings.

This then brings us to the question of what can this organization with propriety do to create a healthy public sentiment which shall aid in preventing hostile attacks on legitimate vested interests that are not dlinquent or have not defaulted in any obligations to the grantors.

MR. WEISSLEDER: Now, Mr. Chairman, that paper is open for discussion, and I would like to see time spent on it to discredit my position in the matter.

The President: The paper is now ready for discussion.

Mr. Reimer: Mr. Chairman, I would like to ask the gentleman whether he knows of the public service corporations who are honestly, fairly and legitimately carrying on their business for the benefit of the public as well as themselves?

Mr. Weissleder: Mr. President, I might answer that question by saying that I have heard, and he doubtless has heard the many sides of where a corporation was not living up to its obligations. It is common rumor, it is passed about in the press by playing shuttle-cock and battle-door with it, and I will say so far as the conditions obtain in Cincinnati, I do not believe there ever has been a fair effort made in good faith to discredit the work done by the corporations. You take the gas company or traction company or the Bell Telephone Company, the Steam Heating Company, they got a franchise, and they live up to their obligations by placing something in the streets of Cincinnati. They selected an alley and placed a couple of pipes in there without connection, without any boiler, without any heating system, and there it lies, and that is the one case where the corporation did not carry out its promise, but on the other hand, the telephone company, which I have the honor to be connected with, has carried out all its obligations and more. It has voluntarily reduced its rate; it has taken the public into its confidence and the late Governor Stone declared in public that this business is a monopoly, but what we want to do is to conduct it so as to get business, and instill good sentiment, and that has largely been done during his life time, and his successors are doing likewise. An attempt was made three years ago by some gentleman that sought a franchise in Cincinnati and appealed to the legislature for it, and they had public hearings on the matter, the committee sounded the public on the question of a rival telephone company in the city, and the consensus of opinion was that a competing company was not needed. The council had public meetings and finally decided to table the application. The result was that they appealed to the probate court, which under the Ohio statue permits a corporation seeking a franchise when it cannot agree with a municipal body to appeal to the probate court. That has been done in a number of instances—in five instances of electric light companies having five franchises. They sought the probate court, and one of its obligations that they said should be imposed upon themselves was that all their wires in the business district, embracing about four miles, should be placed under ground. The probate judge gave the matter a hearing, and decided that the company was entitled to a franchise, and that was appealed by the city, and went to the circuit and supreme courts of Ohio, and in each case the probate court was reversed, because the statute enacted in 1854 provided certain class of construction which could not be constructed to mean underground conduits and wires at that time, but in 1893 the State of Ohio passed a law enabling telephone companies and telegraph companies to bury their wires by laying conduits under the streets, a telephone company having an exchange doing business. That, of course, made it possible for the local company to get proper permits from the city authorities to open streets, which it did, and there never was a protest; it took down miles of poles. Before the cable was in vogue the streets were pretty well filled with telephone poles, filled with ten or twelve cross-arms. That has now practically all disappeared. It is disappearing gradually and being done because the company believes in the betterment of its plant, and giving the people the benefit of good service by burying its wires, and in that manner serving the interest of the public.

THE PRESIDENT: The only paper remaining on the program this evening is on Municipal Situation in Canada, by Mr. H. Bragg, of Montreal. The Secretary has the paper, and if you like, he will read it.

THE MUNICIPAL SITUATION IN CANADA.

BY H. BRAGG, MANAGING EDITOR CANADIAN MUNICIPAL JOURNAL.

Mr. President and Members of the American Society of Municipal Improvements:

Last year I had the honor of giving a lantern lecture on "Canadian Cities" before you at the convention in Montreal, and should have been delighted if it had been possible to accept the kind invitation to read a paper before you this year, and thus be in the position of renewing the very pleasant friendships formed last year. As this is impossible, I feel gratified at being asked to send in a paper to be read along with the other much more valuable ones.

To give even a brief idea of "The Municipal Situation in Canada" is a more difficult task that at first appears, when it is remembered that the area of the Dominion of Canada is larger than that of the United States, although the population—as yet—is so much smaller; and that the conditions of municipal organization and appreciation are very varied and far from being completely developed in different sections of the Dominion.

Speaking in general terms, the three eastern provinces, Nova Scotia, New Brunswick and Prince Edward Island, follow the model of British municipal organization, even the titles of the officials being in many cases entirely different from those in use elsewhere; for instance, the Recorder, (previous to a recent change in one city, Halifax, N. S.), is the same as the City Solicitor in other Canadian cities, and has no judicial functions, but sits beside the mayor in the council, giving rulings on points of order, and opinions on the legal merits of the questions under discussion; while "Common Clerk" is the title of the City Clerk in St. John, N. B., which also has a Chamberlain.

The municipal organization of the Province of Quebec is the result of a very gradual growth since the time of the French *regime*, and has been evolved from the practice of England, with some admixture of the old French manner of doing public work, as has been shown in an exhaustive article by His Honor, Recorder Weir, of Montreal. The municipal code of the Province of Quebec contains some provisions to meet local requirements that must appear strange to those who are unacquainted with the country; among these are clauses providing for the construction and maintenance of ice roads across the rivers between municipalities, with the proper number of *belizes,* or small pine trees to mark the road; also the rules for the calling out of advertisements at the door of the parish church after morning Mass on Sunday, and the judicial sale of property at the same time and place.

The municipal laws of the Province of Ontario are based upon those of Great Britain, but contain modifications adopted from the more modern practice obtaining in the United States, although, very wisely, the plan of electing the technical officials of the city, as well as the judges has been carefully avoided. This principle of making such positions as the clerk, solicitor, chief constable, etc., absolutely permaennt is believed in all over Canada, and has everything to recommend it. Then the powers of the mayor do not correspond with those across the line, but are more in accord with the system in England.

The western provinces have followed the municipal organization of Ontario pretty closely, so far as their newer and less complex needs have arisen. It may be noted that Manitoba has adopted the very simple system of land transfer in use in Australia, known as the Torrens system.

It will thus be seen that the various provinces, or at best groups of them, have various systems of municipal organization and laws. And up to seven years ago there was no united feeling or action among them, with a view to mutual improvement, or the securing of amended legislation of the federal laws. It must, however, be stated that the municipalities of the Province of Ontario to a certain extent had formed a Provincial Association as early as 1899; but they had made no effort to spread the idea among their sister municipalities in the other provinces.

Meantime, as will be easily understood, the franchise grabbers and charter mongers had enjoyed an easy time, and had managed to secure a great number of valuable concessions from the federal parliament at Ottawa, and the provincial legislatures, there being only spasmodic and isolated individual opposition.

Foremost among these concessions was the franchise secured by the Bell Telephone Company of Canada, giving them free access and full control of every street and highway in Canada, without requiring them to obtain the consent of any municipal authority.

As has been invariably the case, the greed of these monopolists led to their downfall. The attempt in 1900-1 of the Royal Electric Company (now merged in the Montreal Light, Heat & Power Company), to secure exorbitant powers led to a rebellion and one which has proved far more important than seemed possible at the time. The then Mayor of Westmount, a live municipality, adjoining Montreal—Mr. W. D. Lighthall, felt that some move should be made to oppose such legislation and secure a small measure of liberty for the municipalities before it was all legislated away. Consulting the late Oliver Howland, then Mayor of Toronto, he found that the same spirit of revolt was alive there, and the issuing of circulars and notices in the press brought some staunch supporters to the side of the founders. A meeting was called in Toronto, and an association formed to embrace every municipality in the dominion, whether large or small, called the Union of Canadian Municipalities, with the avowed aims of mutual study towards improved methods in municipal operations; the improvement of municipal legislation, both federal and provincial; and united action and co-operation in resisting oppressive legislation and the encroachments of private corporations. The union has greatly increased in influence since its inception, and has become a potent factor in the federal and provincial house, while its value and services have been acknowledged by special votes passed by many towns and cities. Two instances may be cited. The first is the change in the Railway Act, by which the control of the streets and roads, which had been taken away from the municipal authorities, is restored to them; and this applies not only to the large places, but to the rural districts also.

Before referring to the second great victory of the union, it may be remarked that the policy of the founders of the union was to secure the formation of provincial unions, formed of the municipalities in each province, who would look after those matters relating solely to the province, and work with the federal union in questions pertaining to the whole country. This has been so successfully carried out that only two provinces at the present time have not formed provincial unions, and both of them are discussing it.

In securing the most recent victory then, the federal unions had the advantage of the active support of those provincial unions, as well as the special support of three of the provincial governments that are in close sympathy with the work of the unions; besides which some of the large cities were specially represented. So that the federal union presented a pretty strong front at the end of a six years' campaign for the rights of the citizens against the Bell Telephone Company. The position of the struggle, briefly, was that the company has secured from the dominion parliament tremendous powers, and that these powers, having been disputed by the City of Toronto, had been declared legal by the privy council—the highest court of appeal in the British Empire. Proceeding to exercise these powers after the usual style adopted by a monopoly, the company had driven the citizens to seek for some chance to curb them. This opportunity was found in the application of the Bell Company for further powers and liberty to increase its capital enourmously. In this the union found the long-looked-for chance, and opened up the fight, arranging for a deputation to wait upon the Prime Minister, which was the most important one that ever went to any Canadian government, because it represented the whole people of Canada. The result was that legislation was passed curtailing the powers of the Bell Company, and restoring to the municipalities at least part of the control of the streets which they had previously lost. and this in spite of the fact the Bell people spent $150,000 in opposing the union. As a result, the company cannot tear up the pavements and erect a forest of poles without asking permission of the local authorities, and the whole question of what they want is placed under the railway commission, which has power to prevent any injustice being done.

The telephone situation is further simplified by the action of the government of the Province of Manitoba, which has decided to build a governmental long distance telephone system, and to guarantee the bonds for any municipal system; while the recent convention of the Canadian Independent Telephone Association proves that the independent movement is making rapid headway in Canada, as it is in the states.

It will thus be seen that The Union of Canadian Municipalities is a force that must be reckoned with in any discussion of municipal affairs in Canada.

In civic government, Toronto has led the way in adopting a board of control in addition to the mayor and aldermen. The controllers and mayor are elected by the votes of all the electors, while the aldermen are elected by separate wards. The board, of which the mayor is *ex-*

officio chairman, prepares the business for the council, in which they have seats and votes, thus taking the place of committees. They receive a fair salary, and give a good deal of their time to the business of the city. As a result of Toronto's experience in this matter, Winnipeg has decided to adopt the same plan, and Montreal is discussing it also.

Municipal ownership does not obtain very largely in the eastern, or older provinces, except in the case of waterworks, which are generally owned by the municipality. At the best, a revenue more or less (and generally *less*) adequate is obtained from other privately owned utilities as a trifling return for the value of the franchise which the citizens have given for nothing, and which they give value to. Montreal, for instance, gets absolutely nothing for the franchises for gas and electric light, the prices of which are exorbitant; and only a small amount from the street railway company. Toronto is better off, as her income from the street railway is over $400,000 a year as her share of the revenue, and yet the company pays 6 per cent. on its well watered stock of eight millions. In too many places, instead of owning the utilities, the municipalities have given away for nothing a perpetual franchise. Two noteworthy exceptions are Guelph, in Ontario, which owns both steam and electric railways, as well as the lighting plant; and Westmount, in Quebec, which has the first plant in America that develops municipal light from the incinerations of its refuse, and supplies its citizens at about half the rate they have been paying.

In the West, municipal ownership is more common, and the newer towns are benefitting by the bitter experience of their older sisters. Port Arthur and Fort William, which though in Ontario, are really in the west of Canada, are well known examples of enterprising and successful municipal ownership; they own their electric light plant, waterworks, street railway and telephone system, and are not only giving good services at low rates, but are reducing the taxes by the profits from these enterprises. Neepawa, in Manitoba, has its own telephone system. Winnipeg is securing a supply of electric power to sell to manufacturers, and the very suggestion of such a thing has made the private corporation cut the price of electricity in half. Medicine Hat, in Alberta, controls the supply of natural gas, and retails it to factories at a very low figure, besides lighting the city for a trifle. Many other instances could be given of successfu municipal ownership in the West.

It is gratifying to be able to say that a spirit of municipal progress is very evident in Canada. The people are realizing more and more that municipal government and ownership require clever and honorable men in the council; that public utilities are valuable; and that private ownership of public utilities—if permitted at all— must be under proper control, and shall yield some appreciable revenue to the citizens who give the franchises and whose money supports them.

It is still more pleasant to note that the thoughtful citizens are awaking to the needs of the city beyond the absolute necessities. The need of more healthy surroundings for the homes of the toilers; of parks and open spaces as a necessity of public health; of playgrounds where the children of the poor can grow into vigorous men and women; of libraries and museums, of picture galleries and concert halls, where mental growth may take place of vulgar and indecent amusements;—in short, of those things which make for the advancement of mankind.

THE PRESIDENT: The paper is open for discussion.

MR. REIMER: There is one question I would like to ask. There was one sentence in that paper which referred to perpetual franchises. I heard it stated at the League of American Municipalities at Chicago, that such a thing could not be, and it might be possibly a matter worthy of discussion to be considered whether a franchise so called, which had been given apparently so that it would be in perpetuity, was a franchise which could be held in perpetuity or whether it was something which nobody had a right, or government had a right to give. It may not be germane to the subject, but it occurred to me the moment I heard that expression.

MR. CHRISTY: Mr. President, that may be a question I heard brought up in our section, and the lawyers all agreed that under our liberal league corporation law, that a charter once given is pretty sacred. The public corporations that have been chartered in Delaware to do public business in Delaware, have gone into business, and there have been times, and occasions came up that the authorities have seen that they would like to curtail or add to some of the conditions of their charters, and they have found by resorting to courts that they could do absolutely nothing. The matter was brought up forcibly when a company that was buying up a gas franchise and the people wanted competition in gas. I think this will get near the question you asked in your paper. The authority that had the granting of the franchise wanted to be assured that the company meant business. There seemed to be one way and that was to pay a lump sum to the city, they seemed to think that would assure the company going into operation. That was argued back and forth and they came to the conclusion that as far as that was concerned, that the old company would have to pay just that much more to buy up a new company. They then turned their thought to putting something in the franchise that would forbid the company selling out to any other corporation, and they found that under the charter, which they were working, that you could add nothing in that line that would hurt the sale of the stock or bonds that they were allowed to put out. That when that company in good faith took a charter under the laws that the legislature set forth, that there was absolutely no way of curtailing any of the conditions. The law there on corporations is pretty liberal, and when they came to the municipal corporations they tack on a great many conditions until it gets. to the question of tax, and the state laws state particularly what they shall pay the state for that charter. There is absolutely nothing that you can add to it that will put them in shape to keep them from being a menace to the old company. The nearest they could get to it was by saying, when upon the payment of a certain portion of their gross receipts they would go into business, but that was no assurance that they would ever go into business. We had a case of a gas company, under their charter they were required to reduce the price of gas when their receipts got to a certain amount; a new company came along and got a franchise, and laid about 300 feet of pipe and sold out to the old company. There were some conditions in the new company that the old company wanted. A plant, estimated to be worth not over a million dollars was immediately made two and a half millions. Of course the conditions in the first company's charter, in reference to the price of gas was put off about one and a half million dollars further. As far as I can see, we are still at the mercy of the corporations. We have to depend a good deal on the good faith of the people, and I am frankly of the opinion that is a bad plank to stand on, by what I have seen.

MR. WEISSLEDER: Since the paper read refers to franchises, both as to gas, electric and telephones, I think it is proper for me to make a few remarks, and I state if a corporation receives a proper grant, and is meeting all its obligations properly in every possible way, is it right for a foreign compnay to come in and be supported by a press? The people will suffer in every instance.

What is to hinder them from purchasing the stock? I just wanted to have this convention hear me defend the honorable action on the part of a corporation. I don't mean that a corporation in default and in every way amenable to the laws, I say then the corporation ought to be made to suffer for its misdeeds.

Mr. Rust: In that paper of Mr. Bragg's, I was going to elaborate a little more on the situation in Toronto. The gas company and electric light compnay and Bell Telephone Company have practically a perpetual franchise as far as the dominion is concerned, and when we wished some time ago to buy out the electric light compnay they went to the legislature. Instead of buying them out we wished to start a municipal plant, they went to the legislature and got an act passed compelling the city to buy them out. We could not start a plant of our own without purchasing their plant. The gas companies are limited to a ten per cent dividend for their stock, and if they earn more than that they have to reduce the price of gas. They have reduced the price of gas, it is down to 80 cents now. The Toronto Railway Company only had a twenty year franchise, and fifteen of that is passed, and when we sold the franchise, we thought we had a very good agreement, but that agreement has caused more law suits than anything else. We get a revenue of nearly $400,000 a year, but we are continually fighting them. It is difficult to get them to live up to the terms of the agreement. It is a rather peculiar agreement in as much as the city engineer has to make the time table for them, he has to approve of the style of cars, and no extensions can be made unless the city enginneer recommends them, and there are several other similar clauses that throws the whole thing upon the engineer, which makes it very awkward for him. We had a contract with the Bell Telephone Company some years ago, in which they paid the city five per cent., but when the aggreement expired, the Bell Company refused to extend it, and since then we have derived no revenue from the company.

A Member: Five per cent. of what?

Mr. Rust: Five per cent. of the gross receipts. The receipts now are over two million dollars. The Bell people have the power under the dominion act to erect poles on any street or highway in the dominion, but in municipalities the engineer has to locate the the poles. That is the only advantage we have. So far we have got along very well with the Bell Telephone Company. They have done everything we asked them to do, removed poles when we requested them to do so, and in other ways have lived up to the franchise that the dominion granted to them. The gas company has been very reasonable, but the Toronto Railway Company is a continual source of annoyance to us.

MR. WEISSLEDER: Speaking about revenues, the Cincinnati Gas & Electric Company pays half of one per cent. of its gross receipts and the Traction Company pays six per cent. of its gross receipts, and it amounts to a good deal. The State of Ohio does not limit the Gas Company, but there is a provision that the city may purchase their works on appraised valuation; but as long as the city does not elect to exercise its privileges, the franchise continues. The existing act was an act passed in the early 90's, permitting gas companies to engage as an electric light company and there is no limitation to time in that case.

THE PRESIDENT: The question is in process of settlement at the present time: I notice the large amount of change in public sentiment on the subject of perpetual franchises, and the courts seem to follow pretty closely the general sentiment of the country. There is a difference between the charter of the company and the contract of the company with the city, and in Indianapolis they have made a good deal out of that difference, and where it is not possible to handle the contract with the city, they have secured what they wanted by calling in the police powers, and in some cases it has been decided practical to make a franchise limited instead of perpetual in that way; that is, where it could be done directly, the condition which has brought about by the application of police powers in the city, that the company was glad to make contracts which would do away with the perpetual part of their franchise; that is, the part of the franchise which depends on the municipality itself. Of course, the municipality cannot interfere with the part

[illegible]

The following gentlemen were proposed and nominated as members of the Committee on [illegible]: Messrs. [illegible]

MR. [illegible]: I move that the nominations be closed and the secretary cast the vote of the Association.

THE PRESIDENT: The motion is made that the Secretary cast the vote of the Society for the five names. Seconded and carried.

THE SECRETARY: The vote is cast.

THE PRESIDENT: The next is the nomination of the Committee on the Place of Meeting.

MR. WEISSLEDER: I move that the Presidnet be made a member of that committee.

The following gentlemen were proposed and nominated as members of the Committee on Place of Meeting: Messrs. M. R. Sherrerd, Geo. W. Tillson, Chas. C. Brown, W. H. V. Reimer, William H. Floyd, Jr.

THE PRESIDENT: Any further nominations? If not, a motion to elect these will be in order.

MR. WEISSLEDER: I move that the Secretary be empowered to cast the vote of the Society.

THE PRESIDENT: The motion is made that the Secretary cast the vote of the Society for the five names. Seconded and carried.

THE SECRETARY: The vote is cast.

The President: The committee is selected. I wanted to announce again that Mr. Bowron will give us a talk on the trip we will take, and we will leave in carriages promptly at ten o'clock, and remember, on Thursday, the schedule we must travel on. We leave the Union Depot promptly at ten o'clock.

Mr. Reimer: Is it fair to ask if the schedule will be like that we have been traveling on coming down here?

The President: The railroad is a freight road, and they have stopped business for us, consequently we must be on time. We adjourn then until 9:30 tomorrow morning.

9:30 A. M., OCTOBER 10, 1906.

The President: Now, gentlemen, it is about time for us to go, and we want to get some explanation of the district we are going over today and tomorrow before we start; and while we are not all in yet, I think it would be well for us to begin the proceedings.

We have with us this morning Mr. James Bowron, who knows the district by heart; he is one of the men who helped develop it, and he can tell us all there is about it, and I have asked him to talk to us as long as he can possibly find time, because I am sure every minute he puts in will be of value to us. Mr. Kendrick is getting the carriages for us and when they are ready for us to go, we will pull ourselves away from Mr. Bowron.

Mr. Bowron: It is always, gentlemen, a pleasure to man to speak to an audience that can think, an audience of men accustomed to listen to facts and to analyzing and appreciating them.

There is a great deal more to be said about Birmingham than is possible to say in thirty or forty minutes, as I am sure you will believe. Many cities of this country are well advertised, for Americans are not prone, as a rule, to hide their lights under a bushel, and he always puts his best foot foremost in speaking for his own city. Birmingham has spoken well for itself, and others speaking for us also, and I don't suppose any city in the country is any better advertised than the City of Birmingham and surrounding district. The reason for that is not far to seek. Other cities are noted for their specialties. If a man wants a locomotive, he goes to Philadelphia, where the great Baldwin works are located; as a rule if he wants beer he goes to Milwaukee; if he was looking for investments in canned meats, he would go to Chicago; if he wanted to buy sugar, he would go to New Orleans; but the existence of the combinations of capital and currents of trade might cause the packing houses or refineries to be turned down; the locomotive works to be moved nearer to the materials and from this the cities of these industrial products would become changed; that, gentlemen, is not the case as to Birmingham. This city is great, is prosperous today, and potentially great in the future, because it is now, and so far as human knowledge and foresight can see, it will continue to be indefinitely fixed by nature, as the city of the cheapest manufacture in the world of one of the world's greatest staples, the article of pig iron. (Applause.) That, gentlemen, is not due to anything that we who live here have done, or to anything that we can do. We may bring together some degree of skill and experience, some amount of capital. Many of the districts in the world can bring together more skill than we have today, and much more capital, but they have not, and cannot get what we have got here, something that the Lord did for the Birmingham district, and that man can never duplicate. (Applause.) That, gentlemen, is such a remarkable proposition that when I draw your attention to it, that an audience of municipal engineers, of men, accustomed, I say, to think and analyze, can see that what I say cannot be regarded as controversial, but a simple statement of existing facts. Let me state for a moment that the State of Alabama is fourth in the production of pig iron; it is exceeded by the States of Pennsylvania, Ohio, and Illinois, in the order named, but the State of Alabama produces more iron ore than those three states combined. You catch the significance of that? The significance is that they have not got the material with which to run their furnaces, and they have to bring it from the great States of Minnesota and Michigan. Look at the production of iron ore, Alabama stands third in the tonnage of production of iron ore; Minnesota and Michigan exceed it, but Alabama produces more pig iron by far than the States of Minnesota and Michigan combined. Why? Because they have to import the fuel, if you please, if they want to make iron out of the ore, which they dig out from underneath their feet, and we have them both together. Mr. J. M. Swank, the President of the American Iron and Steel Association, who has most honorably and ably filled that position, and now Vice-President-Secretary—I got so accustomed to calling him Secretary—who has so honorably filled the position at the head of the statistical department of the Steel and Iron Association for thirty years, has calculated that the average ton mileage involved in the production of pig iron in either the Pittsburg, Cleveland or Chicago districts is from 700 to 750; in other words, the production of a ton of pig iron in either the Pittsburg, Cleveland or Chicago districts involves the payment of freight on one ton of material for 750 miles, or the equivalent of more tons in a shorter number of miles. Right here, gentlemen, you can see today and tomorrow, you can get a birds-eye view today when you cross Red Mountain on your way to the waterworks, and tomorrow you will see from the train as you go around and visit the works, you will see places where pig iron can be made with a ton mileage of not exceeding six, and ranging from that to 25. You will go to Bessemer, so ably represented by my friend, Major Parkes, although he is not there now; still he knows it by heart and will tell you about it when he gets there tomorrow. There you can stand on a hill and throw a rock from the hill at the chute of the ore mines and turn around and throw a rock in the other direction and you hit the blast furnaces. I may point out to you, if I have the permission, as Mr. Kendrick suggested that I accompany you on your train tomorrow, I may have the pleasure of showing you at Ensley the point where within rifle shot of the iron ore (modern rifles, you will remember, will carry five of six miles) not more than five miles in a straight line, although about 15 as the railroads haul it, that absolutely in building coke ovens, we had to take away the coal at the outcrop to lay the foundation for the ovens. There you may stand on the blast furnace and take a six-barrel revolver and you may fire a shot into the mouth of the coal mine, another in the coke ovens, a third in the casting plant where the iron is converted into blocks for the steel works, a fourth one you may fire into the blooming mill of the steel works, a fifth one into the rod mill where the billets delivered from the steel works, delivered red hot and run out into wire rods, the sixth one into wire plant, where the material is never cooled from the moment it comes out of the blast furnace till it comes to an end in woven fence wire. (Applause.) Now, gentlemen, why is this thus, just the simplest possible explanation. In most parts of the country and world we find that the iron ores or especially the sedimentary ores are necessarily of great depth. The igneous ores, which, of course, project, intrude, or extrude, I might better say, and will sometimes drive themselves up, are not to be found here. Why? This is not an igneous ore district. We don't find anything of that sort nearer than small ledges of them cropping up in the Cranberry Mountains of North Carolina, a sort of subsidiary or lateral range to the great Apalachian range. The great iron ore of this district is what is known as the red fossil; it is a metamorphosed limestone of the lower liberian measures and most persistent along the whole Apalachian chain, coming down the entire way from Pennsylvania right down to where we are here in middle Alabama, and of course in most of the intervening country, say, in Kentucky and in the northern part of Tennessee this ore is perhaps from one mile to two miles below the surface of the ground.

When going, say, from Cincinnati to Chattanooga, down the Queen and Crescent System, you are running over that ore all the way, but it is so deep below your feet that it is impossible, economically to mine it and bring it to the surface, but coming to this district, what do you find? Suppose my three fingers represent the bottom finger the lower silurian, carrying the red iron ore; the middle finger the sub-carboniferous rocks embracing the limestone, the upper part carrying the carboniferous measures, and this carrying the coal. Now take, if you please, one of these great upheavals pushing up from below, splitting gradually open, so then what have we got? You have got a great crack in the middle, when the water runs down and washes out a valley and cuts it down and leaves the outcrops of iron ore, limestone and coal on either side standing up protected by the iron ore which you see is the inside one, protected by that from the eroding cutting effect of the rains until you have a long range of hills on either side and a great indefinite valley between them suitable for a river to run down, for a canal to be made, railways to be run, and for the location of blast furnaces, mills, steel works and foundries. There is the genesis of the district, the centralization of the natural material, the bringing together by the great upheaval forces of nature of the iron ore from two miles below until it is thrown right up within range and grasp of the same men working for coal and limestone, bringing it right together until you can take you hat and cover the whole thing, and you have got it in a nutshell. (Applause.) No carrying ore from the length of Lake Superior, the length of Lake Huron and the length of Lake Erie, and then carrying it 130 to 150 miles by rail to the blast furnaces at Pittsburg; no carrying of coal from the Connellsville field to meet the ore at Buffalo, Cleveland or Chicago. It is a strange thing, but true, that notwithstanding the wonderful cheapness with which materials are handled by railroads in this state, railroad freight does cut the biggest kind of a figure in the success of a plant according to its location.

My native country, and that part of the country which until the discovery and exploitation of this district, produced the cheapest iron in the world, the Tees district, with Durham coke on one side of the Cleveland or North Yorkshire iron ore on the other. In a little district, twenty-five miles long by one and a half miles wide, I could have shown you in that "banana peel," so to speak, about 160 blast furnaces and more than thirty rolling mills; a half dozen steel works, at the time I left there at thirty years of age and came to cast my fortunes with the South, and I am glad to say that the only regret I have after thirty years of experience as a northern man and an Englishman, living in the South, is that I did not come thirty years sooner. (Applause.) For the southern people are a warm-hearted people, and as they say, their latch

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string hangs on the outside and while a great many of them who "fought, bled, and died" for the Confederacy, still hold as they have a right to hold after their sufferings and their troubles, strictly to their own opinions, I, as an outspoken republican, never in thirty years had an unkind word with any man in the South, because of my politics. (Applause.) People here, when a man comes don't say who is that man's grandfather; what is his family; what is his politics? They say he has come, has he; what does he do? A man's position in society in Birmingham is gauged by what he does to make himself useful to the body politic, and that is why we. with this degree of energy are envied by some of our western brethern; that is why this southern city, this cosmopolitan city, in the South has grown from the point of, let me see—say, thirty-five years ago, it was that Major Milner and others pulled the first house up, as he told me, with the assistance of a mule and block and tackle, he standing by the first frame shanty. About thirty-five years ago that was done, and today we have a street car population of 150,000 people. According to Mr. Babb, Secretary of the Commercial Club, within the last year 12,000 people have been added to the population of Birmingham district, 2,400 houses constructed and that $22,000,000 has been permanently invested or the expenditure of that amount projected within the past fiscal year of the Commercial Club. So it is that we have only really "struck our gait," if it is permissable to introduce a baseball term in an august assembly of this kind. For a number of years people scoffed at the production of pig iron in the South. One of the first things I heard when I came to live in the South and help open coal mines and build furnaces was, "Well, they do make some pig iron in the South, but I will tell you what they ought to with it. They ought to divide it up into specimens and take it to the different museums of the country and put a glass case over each piece, and label in front 'tread softly, very fragile' " (laughter). Well, gentlemen, a child has got to crawl before it can walk, and walk before it can run, and no doubt they did make some pretty fragile pig iron with 1½ per cent. phosphorus. This was rather up in the Tennessee district, where they began operations earlier than we did here. The iron ore here naturally runs about 85-100 of one per cent. of phosphorus. It is a fact that the first steel rails I ever saw in the South, which were made in Chattanooga, were so high in phosphorus that when they were unloaded they were thrown off the car and several of them broke in pieces in throwing off. Well, everebody has got to wrestle with these things, and by degress we found out we had got some ores not so phosphorous as others; although the red ore contains a great deal of it. We have numerous deposits scattered in the district of brown ores which have leached from the original carbonates and have become crystallyzed into limonites or brown hematite ores with fifty per cent. iron and not containing more than four-tenths of one per cent. phosphorus. These ores are not very greatly used, but lie in pockets instead of the stratified beds and being of quite indefinite volume, are more desirably used as a mixture with red fossil ore, to which I have previously referred. In that way we began to make iron that was not so high in phosphorus, and pushed it a little in other districts, and when we first went in some other districts people laughed at us. I remember in 1879, going to St. Louis, to introduce the iron of the company by which I was employed, and the gentlemen in St. Louis laughed at me and said "My young friend, we would not think of using any iron in our mixture but the great Scotch iron and at least No. 2 Hanging Rock from Ohio." Well, I have lived long enough to send Birmingham pig iron into Glasgow and to send it to Hanging Rock, Ohio, and have sold pig iron for my employers, The Tennessee Coal, Iron & Railroad Company, and shipped it to England, Scotland, Ireland, Holland, France, Belgium, Russia, Germany, Austria, Spain, Italy, Greece, Egypt, India, Burmah, China, South Africa, Australia, and Japan. (Applause.) Think of it, gentlemen, that we should have to make pig iron here, in Birmingham, in an inland city, and send it 258 miles by rail to the nearest shipping point upon the sea, and still compete with cities that are located upon the tide water! What a wonderful testimonial that is to the ability to make pig iron cheaply here.

I have heard it said that no great city can exist which is not located upon navigable water. That statement has become almost proverbial because in the very nature of things in a country so fast as the United States in the growth of our population and development of the country our cities have been compelled to be located originally where men could get about either by sea or by river or by lake, because this country was settled before the initiation of railroads, and men could not get about any other way, but how idle is it to suppose a great city cannot exist without navigable water. Let me point a moment to England, and such great iron cities as Birmingham, Sheffield, Leeds and Wolverhampton. By crossing over the continent, you find great national capitals as Berlin. and Dresden, each of which is on a river, but neither river navigable and which is served by canals; Madrid, Milan and the great manufacturing cities in Russia—Kiev and Moscow. It is out of the question to insist that a city cannot exist without navigation, but let me tell you something, this city, such as it is, is going to have navigation. The United States Government, slowly and by piecemeal is very laboriously one step at a time, one lock after the other, giving us navigation on the Warrior River, and we have today a navigable water, I believe, touching the extreme southwest corner of Jefferson County, in which we are now sitting, and in the course of three or four years we will bring the navigable water up to a point where the Secretary of War has recommended to congress as feasible and suitable the project of the canalization of Valley Creek up to Bessemer, and Village Creek up to North Birmingham. The time will come within the lifetime of many of those here present, when the manufacturers of Birmingham instead of paying a toll of $1.00 on pig iron for export or $1.00 on coal for export will send it by barge down the river according to the estimate of the Secretary of War for twenty-five cents a ton, and with the opening of the Isthmian canal will absolutely command the world's trade on pig iron and coal upon the Western Coast of the North American Continent. These, gentlemen, are not idle dreams, some of us know what we are talking about. Railroads make exceedingly good rates, make lower rates than could be given were it not for the fact, as I said, we are 258 miles from the gulf, but we are at the Union depot here in Birmingham, 602 feet above the sea level, therefore, you see that gives two feet and two inches to the mile in favor of the loaded cars going with our iron and coal down to Pensacola or Mobile; and that is why they can make exceedingly low rates. I want to say further that the great railroad systems, prominently the L. & N., Queen and Crescent and the Southern Railway, have worked manifestly for the upbuilding and development of this district. They have handled the raw material at prices that absolutely left them no profit. They handled the whole thing by zones and they bring in from a zone of a certain number of miles the ore, coal and coke for the furnaces, and the pig iron for the rolling mills at 12½ cents per ton. They have treated the district with extreme liberality, realizing that by so doing they would build up a large city with enormous shipments of finished products, which would pay them profitable rates and develop a great populous district where the movement of passenger traffic and miscellaneous freight give them splendid revenue. Today I insist that as chickens come home to roost, the great success of the Louisville and Nashville Railroad, the splendid revenue it is earning, that 7 per cent. of its stock today is due to the foresight and energy of one Milton H. Smith. Twenty-five years ago, when this district was in its infancy, he ran his tracks into every mine he could get to and other men have come since and done equally as well according to their capacity.

Now, I was saying that this district is still just striking its gait. I spoke of the poor quality of iron we made, but we pushed ourselves out, and the people began to say there is a little iron going to the East, but it does not amount to anything, it amuses them and don't hurt us; and by and by, a year or so later, they said a great deal of that stuff is coming up, but we know it is no account, and they have to sell it a dollar a ton below what anybody else gets for their iron. It don't pay and they will have to quit; and we kept pushing, and by and by they said these fellows are sending lots of stuff up here, surely they cannot get money anywhere else, and if you give them rope enough they will hang themselves, and it will be an end to it. We still kept on, and by and by they began to pay the same prices as they paid for their own iron. Well, they said there is a market for a lot of this stuff, but we know it has not any strength in it and has a good deal of silica and makes sharp castings like architectural castings and stoves and radiators, and things of that sort, where you want to have your iron as fluent as water, but will never do for engines and strong castings, etc., and besides that it will never do for steel. Now, gentlemen, the growth of steel and the way steel has crowded iron out is one of the wonders of our age.

The strongest factor in convincing the directors of the Tennessee Coal, Iron and Railroad Co. that they would be compelled to go into the manufacture of steel in the South was a pamphlet I compiled, in which I showed year by year how the proportion of iron going into the steel was increasing, and the proportion of iron used as iron was decreasing. Do you know, last year there were 23,000,000 tons of pig iron made in this country, and nearly 20,000,000 tons of steel made. The whole 20,000,000 was not made out of pig iron, because a great deal of scrap iron went into the manufacture and certain portions of crushed ore, and it is not unreasonable to suppose out of the 20,000,000 of steel 19,000,000 tons of pig iron went into it, so that only left 4,000,000 tons to be used as iron, instead of being converted into steel. Now, thereon hangs the tale, and on that tale is the development of this district. Out of the 20,000,000 tons of steel made last year, 11,000,000 tons were Bessemer and 9,000,000 open hearth. Twenty years ago open hearth steel was not a curiosity, but a thing that was not looked upon as any very great improvement. All the rails of the country were made out of Bessemer steel, and practically everything else was made of Bessemer steel. They said we cannot afford to pay $1.50 or $2.00 per ton more for open hearth steel because in those days men made open hearth steel expensively in one ton and two-ton furnaces; then by degrees the genius of the American mechanic came along to the rescue, and instead of making open hearth steel in little furnaces, they begun to make it in thirty-ton furnaces and fifty-ton furnaces, and then the genius of another man came along, and he was an Englishman, too, and he worked side by side with me in the same employment. He worked at Chattanooga; he discovered the method of Talbot process, and by the Talbot process, discovered at Chattanooga, instead of the mechanical mixture of solid iron ore containing oxide of iron to oxidize the metalloids in the pig iron, charge or oxidize the iron molten in a slag bath by pouring the iron from the cupola or ladle there is a condition of instantaneous molecular contact and the oxide cutting loose your metalloids from the molten pig iron, and the phosphorus cut loose from the iron catches to the lime of the slag and makes a phosphate of lime, which being stable enough not to go back into the iron below, you pour your slag off, and there you have your fifty tons of pure metal.

When you make Bessemer steel, and I have very little doubt that every gentleman in the room is familiar with the manufacture of Bessemer steel, you blow freely until the metalloids are oxidized and decide by the spectroscope theoretically, but really by the eye of the men making the blow, and as soon as your smoke turns brown, the man says "We are beginning to burn iron, shut it off quick." Manifestly that is a rough and ready proposition and a question of 22, 23 or 24 minutes, so you cannot tell to 1-10 of one per cent. what you can take out or what you can leave in, and therefore you get a steel for making rails, boilers, etc., which may vary by a tenth of one per cent. in such elements as phosphorus, but you cannot get steel the same high quality that you can market it in an open hearth furnace. Where you dig a ladle in and bring out a sample and put that in water and break it to see its granulation, you note its appearance and judge by an experienced eye, and be absolutely sure that you put it through one of the modern processes and by centrifugal force, you find the degree of the purity of the metal and let it go on another twenty or thirty minutes, according to its necessity. The result of this is that today open hearth steel can be made at substantially the same price, at the same cost, or within fifty cents or so of the same cost of Bessemer steel, and you have a product which may be worth from $1.00 to $2.00 to $3.00 a ton more because of its greater purity, its greater ductility. When I talked with the director general of the Royal Swedish Railway System upon the quality of steel rails, I told him what has since come to pass, that the rails made there would by reason of the process be of such high quality that they would be worth at least a dollar a ton more money, and he agreed that in the extreme arctic circle, they would be worth more, and he would be willing for the Swedish government to pay a dollar more for open hearth rails than for Bessemer. Now, beginning with making pig iron, which had to be put in a museum and labelled tread softly, for fear of breaking the specimens as you pass, you come today to the position where the man who makes stoves, radiators and architectural castings would rather have Birmingham iron than Scottish iron, because our iron runs as sharply and makes as clean and sharp a casting with as clean a face, and has not more than half the phosphorus in it, and not more than half the shrinkage. We have proved that we can make iron of low silicon quality. I have seen pig iron made right at the Alice Furnace down the street in the blast furnace containing .02 or 1-50th part of one per cent. of silicon made in a blast furnace, and iron practicaly as nice in the blast furnace as you get it in the old-time ordinary iron refinery. If we want to make a low silicon iron we can run on the hard red fossil ore, which contains its own lime, and which has a surplus of lime, so that every atom of silica in the ore is already mated to an atom of lime and goes off in the slag with it; we can make iron so low in silicon and tough that we can make car wheels right here in Birmingham, and do make them out of our own iron. Melt the old wheels over and bring them in as part of a mixture and add our iron. We can build Corliss engines with our own Birmingham iron. Go to the Hardie Tynes plant and they are running on nothing else but Corliss engines, sending them to New York and Pennsylvania. Go to Dr. Boland's plant in East Birmingham, and you see numerous makes of machinery for the sugar mills in Louisiana and Cuba. The day is coming and not far off, when, with the opening of the Isthmian canal to the completion of which the energy of Hon. Theo. Roosevelt and the power and financial ability of the United States Government is pledged, we will have in the Gulf of Mexico a harbor of safety where the steamers are going to save from four to six thousand miles by going through the isthmus instead of going around Cape Horn; when the steamers from London, Liverpool and Hamburg will find their quickest route to Japan, China and Australia by going through the isthmus instead of going around Cape Horn, we will find great harbors made which nature has already largely provided for, in the great harbor of Mobile bay, with its twenty-six foot channel and the area of forty foot deep water inside of that great sand bar that protects it from the outer surf. In the great Bay of Pensacola we have a great natural harbor, there gentlemen, many of you are going to see the day when the great steamers will be constructed at Mobile out of plates rolled forty feet long and one and a half inches thick and eight to twelve feet wide, which will be rolled at Ensley, Birmingham, Bessemer or North or East Birmingham, with equal facilities out of the open hearth steel made here in Greater Birmingham, which will be barged down our canal down the open Warrior River, and will be followed by barges of coal, which today, after paying 267 miles of railroad freight, we put on board ship in Mobile and Pensacola. I, coming from the English North Country coal mining regions, and having been in business there, know what I am talking about, and I say this coal can be put on board ship on the gulf coast $1.00 for $1.00 and ton for ton the same price that coal can be shipped after hauling it ten, twelve or fifteen miles by railroad to Sunderland and Newcastle, that being so the English steamers will carry all the freight they can carry; they will not load up with bunker coal in England, but will utilize all the space they can. They will will put in between trips at our Southern ports, and the whole tendency of the growth of the Western coast of the American Continent will be towards the upbuilding of this favored section; favored by the river navigation and open harbors on the coast, which are now being developed, favored by the capital and energy of a cosmopolitan people, Americans from the East and West, Canadians from the North, Englishmen and Germans and others coming here as they are going to other points of the country, favored by a benignant climate, where we are never troubled with the ore being frozen in the bins, where we never have our coke frozen in the cars; where we do not suffer by our tuyeres and water jacketing being burst over night by the frost, as so many of our friends in the North have to combat and struggle against: favored by a climate that permits the houses to be built of cheap construction, by a climate that inflicts upon our labors the smallest possible charges for clothing to resist the cold, and which permits the people to live largely upon a vegetable diet, raised in truck farms surrounding their cottages, if they will, without the expenditure being made for food which is required on the part of those living in cold climates; favored by a climate where work is not suspended even in the hottest part of the year by reasons of the heat: for while we have a more protracted heated term than our friends up North, it is not so severe, and our heat is a dry heat, and our nights are cool. In this favored valley where we live, the great mass of heated air rises during the day, and clear breezes from the gulf, push and sweep their way to us in the evening, so that by half past ten almost every night in Birmingham the leaves of the trees begin to rustle, and the evening breeze coming from the gulf through great pine forests casts its soft and balmy resonance upon our skins so that our nights are always delightful. With the warm hearts of the people, always extending a welcome to those who come and mix with us: with a diversity of our industries, iron, steel and coal filling prominent positions, closely followed with the great diversity of collateral and subsidiary forms, cotton following in their wake, rolling stock, room for the construction of locomotives and cars and track material, room for practically everything that can be produced from steel, iron and lumber and textiles or that can be produced from cotton. Oh! how great the future, man may make here, when American energy, American skill and money shall be placed and combined with that which the Lord has already done for us. (Applause.)

The President: I am sure I voice the sentiment of the Association when I thank Mr. Bowron for his address. The time for our trip has come, and you will find the carriages at the foot of the steps and Mr. Kendrick will be there to locate us.

Mr. Rust: I have listened with a great deal of interest to the able address delivered by Mr. Bowron, and I wish to move a vote of thanks of the Society for his delivery of the magnificent speech. I, coming as I do, from the North, must say I am very much pleased and interested in the address of Mr. Bowron, and I am sure most of us are very much pleased with the speech.

THE PRESIDENT: Those in favor of this motion will please rise. (The motion was unanimously carried.)

Adjourned until 8:00 P. M. October 10.

8:00 P. M. OCTOBER 10, 1906.

THE PRESIDENT: Gentlemen, you will please come to order. We have a pretty full program for tonight, and it will be necessary for us to begin it. Before the program begins, I wish to appoint a committee which has been neglected heretofore, and that's a Committee on Resolutions, which will be expected to report on Friday.

THE PRESIDENT: We have the pleasure tonight first of listening to a paper by Mr. Geo. G. Earle, which will tell us of the good work that is being done in New Orleans on the new water works and sewerage of that city:

PAPER ON THE NEW ORLEANS WATER WORKS, ILLUSTRATED WITH THE STEREOPTICON.

BY GEO. G. EARLE, GENERAL SUPERINTENDENT SEWERAGE AND WATER BOARD, NEW ORLEANS, LA.

Preliminary to description of the water works of New Orleans, now under construction. it will be best to introduce to your attention something of the general conditions which have surrounded, and in a large measure controlled, the development of the local situation to the present time.

New Orleans was founded in 1718, and under French government until 1769, from which date, until 1803, she was under Spanish control. In 1803 after the Louisiana purchase she passed into the hands of the United States with a population, largely of mixed French and Spanish origin.

Located at the ocean gateway of one of the greatest systems of navigable waterways in the world, when heavy transportation was compelled to move almost entirely by water, New Orleans became at once a city of destiny, and despite natural obstacles, she was in 1800 the fifth city in the United States in population.

In 1800 to 1830 the rate of growth of New Orleans paralleled the growth of Boston, Baltimore and Philadelphia, reaching a population of 46,000 despite an average death rate of over 42 per 1,000, brought about by unsanitary conditions, and particularly by frequent visitations of yellow fever, introduced by commercial intercourse with tropical countries of the South.

From 1830 to 1840 New Orleans more than doubled her population, passing the 100,000 mark, and reaching the position of the fourth city of the United States in population, only New York, Philadelphia and Boston had a greater population. and the two last named had but a few thousand in advance. The growth in population came notwithstanding an annual average death rate of nearly 60 per 1,000. During the decade severe yellow fever epidemics were of frequent recurrence, and for two years cholera raged with a death rate in the worst year, which removed nearly one-sixth of the total population.

That the city doubled in population under these conditions speaks volumes for the logic of her location.

After 1840 the logic of location gave way to the more inexorable logic of death, and the growth of New Orleans as compared with other cities showed favorably only in the cemeteries. From 1840 to 1860 the death rate averaged about 58 per 1,000 of population—far more than double that of other cities.

The war brought an embargo of commerce from Southern ports, and a general cleaning up, with some crude efforts towards drainage, which reduced the death rate from the decade 1860 to 1870 to about 40 per 1,000, despite a terrible yellow fever epidemic, which followed the renewal of commerce in 1867.

In 1873, and again in 1878, frightful epidemics of yellow fever were experienced, but the average death rate for the decade was cut down to something like 32 per 1,000.

After the experience of 1878 the State Board of Health was reorganized, and an efficient quarantine was established at the mouth of the river, which prevented the introduction of yellow fever in the decade 1890 to 1900, and the death rate was reduced to the average of 28.5 per 1,000.

From 1890 to 1900 conditions affecting the health of the city remained substantially as in the preceding decade, except that yellow fever found entrance through another port and reached New Orleans by infection brought from this point in 1897, and was present in the city in decreasing amounts in 1897, 1898 and 1899. These visitations of fever were not severe, and had comparatively small effect upon the death rate. which averaged about 27 for the decade, standing at that figure for the last two years thereof.

In 1900 New Orleans had a population of 287,000 and stood the thirteenth city in the United States in population. Her decline from the fourth place, which she occupied in 1840, may be charged partly to the fact that railroads leading east destroyed the power of inland water transportation to command commerce, and partly to the retarding influences of the war, and of the era of the so-called reconstruction, when incompentent and corrupt rule plunged the city and state into a sea of debt, from which they are only now beginning to emerge. But the sanitary conditions of the city and the evil sanitary reputation, which lingered, even as the conditions began to improve, have been the chief causes of her failure to grow from within, and to attract growth from without.

If some power could have reduced the death rate of New Orleans to 20 per 1,000 in 1867, and maintained it at that rate, there is little doubt that she would have had a population of over 500,000 people in 1900.

The main cause which prevented sanitary improvements on an adequate scale was a conservatism, which pointed to natural difficulties, that were claimed to be insurmountable. A large element of the population really took a pride in saying that the city could not be sewered or drained, and that the waters of the Mississippi River could not be purified on a scale adequate for a public water supply. The result of this conservatism was that nothing was undertaken.

It is true that the conditions in every respect were most difficult. New Orleans is practically in the center of an alluvial plain, which has been built up by the deposit of the silt laden waters of the Mississippi River, which river has in recent geological times advanced a coast line 100 miles long, an average of about 80 miles into the gulf from the original gulf coast. This great alluvial plain lies at just about mean tide level, and is intersected by old river outlets, along each side of which a narrow strip of land has been raised by the heavier deposits of the overflows to a few feet above the tide level, sloping gradually back to the tide level, swamps, lakes and bayous in the rear. Through accretions of fine silt, and through the growth and decay of vegetables, with a gradual subsidence of the accumulated mass, a new land was being slowly created by the force of nature. Its fertility was a temptation not to be resisted, however, and very early in the history of the country, every available elevation capable of cultivation was taken possession of. Gradually levees were constructed to prevent further overflow from the river, and thereby nature's process of gradual filling has been arrested.

New Orleans was located solely with a view of taking every advantage of the opportunities for navigation, which existed, from that standpoint, the location could not have been better chosen.

The city itself, or that part of it which is receiving any consideration in present development, covers an area of about thirty-three square miles, and could easily accommodate a population of 1,300,000 people. This area is bounded on the north by Lake Pontchartrain, and on the south by the Mississippi River and on the east and west by levees. (Incidentally, it should be said that there are levees between the city and its north and south boundaries also.)

The Mississippi River is about one-half mile wide, and from 90 to 180 feet deep at New Orleans. At low stages of its water, the river surface rises and falls with the gulf tide, and despite the fact that its minimum discharge is 200,000 cubic feet per second, and its distance from the gulf 100 miles, we often find its surface at New Orleans practically at gulf level. At high water the river surface is nearly twenty feet above the gulf level, and its discharge something like 2,000,000 cubic feet per second, and every foot of natural ground in the city except the levee tops is from six to twenty feet below the water level of its seething yellow waters.

Lake Pontchartrain, the northern boundary of the city, is really a shallow arm of the Gulf of Mexico. slightly brackish and effected by the gulf tides, which have a daily fluctuation of only a few inches, but which depend upon the influence of the winds and have an extreme range of over six feet, from more than four feet above to nearly two feet below mean gulf level. The thirty-three square miles of area of the city, with reference to mean levels lie as follows: Seventeen square miles at from two feet below lake level to lake level; seven square miles at an elevation between high and mean lake levels, and nine square miles from high lake level to ten feet above said level, but still from five to fourteen feet below the level of high water in the Mississippi River.

The natural soil is practically all an alluvial deposit or a product of such deposit in vegetation more or less decayed. Irregular strata of sand from fine to coarse, and clay from very soft to reasonably firm, and mixtures thereof, roots and peaty strata, with cypress stumps and logs from forests of other days, some decayed and some very well preserved all go to make up a soil condition, which for underground constructions or for foundations present an average of cost and difficulty not often encountered.

The bearing of the above outlined conditions upon needed sanitary improvements at New Orleans, especially upon sewerage, water works and drainage, is obvious, particularly as one board is charged with the three works, with a common fund, so that the development of either is necessarily to a degree dependent upon the other two.

In 1892, when the writer first located in New Orleans, the city had no sewerage system and no underground or deep drainage, the then existing drainage being only a matter of surface gutters leading into open canals, in which the water always stood within two or three feet of the ground level, which was overflowed for hours and, in parts, sometimes for days after every considerable rain.

Of the 60,000 premises then existing each had a hole in the ground to receive fecal matter; each discharged its liquid wastes into the open street gutters, and each depended for its clear water supply, and usually for its whole water supply, upon cisterns, i. e., cypress tanks built above ground and precariously supplied with rain water from the roof of the premises served. About one-tenth of these 60,000 premises had also a connection with the mains of the New Orleans Water Works Company, which only covered about 100 out of 350 miles of built up streets and supplied Mississippi River water (and mud) to its consumers. This water, filtered through stone filters, was and is a magnificent water, but in its natural state, as drawn from the mains, is really unfit for practically any use.

The New Orleans water works system, as now existing, dates back to 1836, when a private company with a franchise, started its construction and gradually extended it until in 1868 it covered about 65 miles of streets—at this date it was purchased by the city. Private ownership had been bad, but in this case public ownership proved worse, and in 1878 the city sold to another private company, organized under a state charter, retaining this time about one-fifth interest in the property. Both transactions were largely paper transactions in depreciated securities.

The new company made considerable extensions, bonding the plant to cover their cost, and by rather high rates and the application of earnings strictly to dividends, paid five to six per cent. dividends on the $2,000,000 of capital stock, besides paying interest on some $700,000 or more of bonded indebtedness. This brought the stock to par, or above, and with a franchise extending for something like thirty years, the present earning capacity and possibility for future extension and increased earning capacity outweighed the actual value of the plant, and the prospects of the water works company seemed very secure.

There was, however, among the people of the city, a strong feeling of dissatisfaction with both the service and the rates of the company and a desire to recover for the city both the sewerage and the water works franchises which had been given out. the former not having been carried out to even such an extent as to render *any* service, and the latter not having been made to produce a service in any sense satisfactory. As a result litigation looking to the forefeiture of both franchises was started.

In the case of the sewerage franchise this litigation was settled by the purchase of the constructed works at little more than the cost to duplicate them and their incorporation in the new system. No similar compromise being possible in the water works case, it was carried through to the United Supreme Court and resulted in the forefeiture of the company's charter on the ground that they were charging inequitable rates and rates in excess of their franchise rights. During this litigation the city had been making progress in the construction of a great drainage system, and had also framed and passed a law creating a Sewerage and Water Board and authorized a tax which amounted to .004 on the assessed valuation of the city to be levied until 1942 and to be expended either as interest on a $12,000,000 bond issue for (and any surplus to be used in the construction of) a sewerage, water and drainage system.

Under this law sewerage and water for sewerage uses and for public and charitable institutions is to be free, and paying consumers on the water works are to be charged only such rates as are necessary to pay the cost of water works maintenance and operation; and it was further stipulated that not over one-third of the funds thus made available could be expended on drainage until sewerage and water works systems were completed over the entire populated area of the city.

Shortly after the creation of the Sewerage and Water Board, the operation of the drainage, and any further drainage construction, was placed wholly under their jurisdiction; so that the three works have received equal consideration at their hands.

The major part of the drainage construction done to date was executed before the existence of the Sewerage and Water Board, but they were required from their funds to take up outstanding drainage bonds and carry forward outstanding drainage contracts, all aggregating $3,900,000, and it was evident that the full one-third of the total funds permissible by the law would need to be used for drainage improvements.

The Sewerage and Water Board, therefore, undertook these three works with a limit as to resources, which proved very embarrassing when the lowest possible cost of the three improvements was calculated.

The problem present was how, out of a $12,000,000 bond issue, to build 400 miles of sewers and necessary pumping stations at an estimated cost of..................................	$5,300,000
400 miles of water mains and pumping and purification plants at an estimated cost of..................................	5,500,000
With connections to both systems to the property line, estimated to cost not less than..............................	1,500,000
And take up outstanding drainage bonds and contracts, aggregating	3,900,000
Or a total of..................................	$16,200,000

The solution of the problem, after careful study, was in the following form:

The fixed income of the board approximated a four-mill tax on the constantly increasing assessed valuation of taxable property. This income could be expended either as interest on outstanding bonds, or any surplus, after payment of interest, could be expended on construction. The $12,000,000 of bonds were sold to a syndicate at a price which netted the Sewerage and Water Board $12,550,000, but are only issued to them as the money is needed to carry on construction work. By fixing the rate of construction expenditures so as to complete both systems by the end of 1908, thus building part of the system out of the annual income, and arranging to make the greatest expenditures out of money from the bond issue in the latter part of such period of construction, it was shown that there would be a great saving of interest and a total sum available for expenditure on construction equal to the amount above named, and this policy was, therefore, adopted and publicly announced in 1901.

With time, however, it has been found necessary to extend and improve the drainage system to the full limit of expenditure legally available therefor, and the necessity to continue drainage improvements upon a much larger scale has resulted in legislative authorization to increase the bond issue by another $8,000,000, which further issue it is shown can easily be carried and liquidated before 1942 out of the tax already voted, still leaving a considerable annual surplus to be expended upon extensions of the three systems.

If this last issue is voted and placed New Orleans will obtain, as rapidly as the money can be judiciously expended, such improvements in drainage as will bring all three systems to a very high state of efficiency. The expenditure will stand something as follows:

Sewerage and connections	$6,500,000
Water works and connections	6,600,000
Drainage	10,900,000
Total	$24,000,000

Without the additional issue sewer and water works systems, exclusive of connections to the property line, will have been completed by about the end of 1908, and the drainage will have received such expenditures as were allowed under the law, and will be in condition to handle satisfactorily anything except the very greatest storms. Further extensions and improvements without the bond issue can only come gradually as the annually increasing surplus from the tax will pay for them. In 1909 there will be, for instance, a surplus of over $300,000, and by 1920, by most conservative calculation, this surplus should be over $600,000. In other words, it will take probably twenty years to bring the improvements which can be made in three or four years out of the $8,000,000 bond issue if such issue should not be made.

In establishing the basis of design for the Water and Sewerage Systems the factor of cost of operation had to be kept very clearly in view, and in order to expedite the real work a meeting of the Advisory Board of Engineers was called to review and authoritatively eliminate from further consideration so many of the numerous projects and suggestions, which are always urged when works of this character are contemplated, as evidence then available would warrant the elimination of.

Projects thus eliminated were numerous, including the further consideration of a local artesian water supply or of the bringing in of water from either artesian wells or from surface supplies of relatively clear waters available from water sheds of small rivers north of Lake Pontchartrain by a pipe line 40 miles or more in length, depending upon the locality chosen, it being conclusively proven that either of these projects would increase the cost both of construction and of operation greatly beyond the cost required for the purification and utilization of the Mississippi River, that such increased cost was beyond possible consideration with the money in sight, and that these projects offered no advantage to make them worth further consideration.

These projects were quite widely favored, and there was a large element who doubted the possibility of adequately purifying the Mississippi River water upon a scale and at a cost which would make it available for a public water supply. The fact that one of the big filter companies had failed utterly to carry out their guarantee, or to anywhere nearly produce a satisfactory result in a filter plant erected for the New Orleans Water Works Company in 1892 and 1893, was used as an argument, and to those who had no knowledge of the advance made in water purification subsequent to 1893, this argument was quite convincing.

In order not only to show to the people of the city the entire practicability of the project proposed, but also to determine the various factors which should govern the design of a large plant, an appropriation of $25,000 was made for the construction and operation for a year of a small experimental plant to purify 100,000 gallons of water a day, with arrangements to try both slow sand filtration and so-called mechanical filtration. with various periods of plain subsidence and of coagulation; and with a laboratory force and equipment adequate to make chemical and bacteriological examinations of the water at every stage of purification.

This plant was established in a public park, and the public were invited to visit the station at any time and were shown as much of its workings as they cared to see. The moral effect of continuous streams of perfectly clear water during the entire time that this plant was in operation was alone worth its cost; and the practical data obtained bearing upon the proper design of a plant to meet local conditions was worth many times this cost. The results of the investigation were substantially as follows:

The Mississippi River water was found to show practically no evidence of pollution despite the immensity of its water-shed and the great amount of sewerage entering it and its tributaries. It contains, however, a very large amount of very finely divided clay particles and, at times, of very fine sand in suspension, ranging from about 200 to 1,500 parts per 1,000,000 of suspended matter, rendering it almost always very muddy in appearance. Freed of this suspended matter it is a colorless and perfectly clear water, unusually pure from a sanitary viewpoint, but containing in solution enough of the carbonates and sulphates of lime and magnesia to be called a moderately hard water—not nearly so hard, however, as very many waters used and highly esteemed as water supplies—and containing also considerable amounts of dissolved carbonic acid gas and oxygen.

The original investigation looked only to the removal of the suspended matter and was conducted with sulphate of alumina as a coagulant and proved that a period of 12 hours for plain subsidence, and an equal period of auxiliary subsidence, with coagulation followed by rapid filtration, was best adapted for the economical clarification of the river water. Often plain subsidence was of no effect, but when the water was very turbid a great deal of the coarser matter was eliminated by a short period of plain subsidence and the saving of coagulant warranted the 12 hour period of plain subsidence, as well as the unusually long (12 hour) period of auxiliary subsidence after coagulation. The average removal of suspended matter in 12 hours was about 35 per cent., but longer periods were of so little additional benefit as to be practically useless. Following this first investigation the laboratory, with a diminished force, has been retained continuously, and as a result of experience elsewhere, and further studies in New Orleans, it has been decided to go a step further and soften as well as clarify the river water. This decision has been reached because it was found that by the substitution of the lime and iron process a soft water could be obtained at practically the same first cost and cost per 1,000 gallons that would have resulted from the process first studied, and it was considered that with a population used to a perfectly soft cistern water there would naturally be some objection to even a moderately hard water.

Another matter requiring careful consideration was the question of per capita supply to be assumed in designing the system. The cost of chemicals for purification, the cost of cleaning out mud from reservoirs, the cost of pumping water two or three times before it reached the consumer, and the pumps and cost of the distribution system were the first factors to be set down in arriving at a conclusion in this matter, but they were not by any means the only ones, as having brought a clear water supply to 65,000 premises we must arrange to take it away again as it was fouled by the various uses to which it would be put, and the cost of sewers and pumps and pumping for all time to come for from one to three lifts before it was discharged again into the Mississippi River had also to be considered.

Weighing all of the above considerations the sewerage and water works systems were designed with a view of an average water consumption of 100 gallons per capita and a maximum hourly rate of consumption of 180 gallons per capita with liberal allowance for fire protection in the adjustment of the sizes of sub-mains on the waterworks system.

The site chosen for the water purification and pumping station is located at the extreme upper end of the city and about 4,000 feet from the intake. At this point an area of some 65 acres, covering some 26 city blocks, has been acquired at a cost of about $70,000, which area will be adequate for a city of 1,500,000 population. This location combines the following advantages: It is close enough to the river to permit of the placing of the low lift pumping machinery under the same roof with the distribution pumps, making only one mechanical plant for waterworks operation; it takes water from the river just as it reaches the upper end of the city, and is properly located for a purification plant if in the future for some reason it is desired to move the intake further up the river, or even if it should be found eventually that water from north of Lake Pontchartrain possesses some advantage over Mississippi River water not now apparent. It is located so that the construction of a 4,000 foot switch track connects with the Illinois Central R. R. with the proposed City Belt line, and with a wharf located at the waterworks intake, so that coal, coagulant and other supplies can come by rail or by river and be economically handled from either point.

Again, this location permits of the present construction of a main supply line, large enough for present needs, which will reach the center of population of the city at the shortest possible distance and run through or just in the rear of the present populated area of the city, while future lines, built through areas now open, as these areas build up, will also reach the center of population by equally short routes.

In designing the ultimate distribution system the city is divided into three zones: first, that in which the most distant point is 25,000 feet from the pumping station; second, that in which the most distant point is 33,000 feet from the pumping station; and, third, that in which the most distant point is 50,000 feet from the pumping station.

The main lines supplying the first zone are designed to have frictional losses under maximum discharge of 4 feet per 1,000; in the second of 3 feet per 1,000, and in the third 2 feet per 1,000; so that with a little over 200 feet head at the pumping station the pressure at the most distant portion of either zone will not fall below 100 feet.

For present construction only the smaller mains intended for the supply of the first zone will be required, while the big main eventually intended for the second zone alone will supply both the second and third, all being sufficiently cross-connected by valves so that they can be worked either together or independently, as experience or temporary necessity may require.

The arrangement of valves and cross connections on the distribution system is devised with a view of being able to shut off pipe lines into about four block lengths. Fire hydrants are being placed one at each street intersection, always on the upper river corner just beyond the property line, the average distance apart of street intersections being about 350 feet. In the business section about as many more hydrants will be placed, the additional hydrants being located close to the street corner diagonally opposite to that upon which the regular hydrant is set. Valves are always set opposite the property line, the pipe being cut to maintain a standard location. Hydrants are never taken off any line smaller than 6 inches in diameter, said line being not more than four blocks long and fed at both ends usually by 12-inch lines or larger. In the business section larger sub-mains are to be used. In the residence sections of the city hydrants are 4-inch supply and barrel, with two 2½-inch hose nozzles; in the business section they are 6-inch supply and barrel, with two 2½-inch and one steamer nozzle. The Matthews compression hydrants is being used throughout.

The insurance insterests have urged the use of large pipe, larger hydrants and infinitely more complicated and expensive valve and cross connection arrangements; also higher pressure. The Sewerage and Water Board, however, has to consider the cost and the other uses for a waterworks system, and while they would like to be able to build the finest distribution system for fire protection in the country they cannot afford to go the lengths advocated by the insurance interests, nor can they ignore the fact that very high pressures mean waste and great inconvenience in general use. The present layout will probably allow of the concentration of steam fire engines in or near the business center of the city, where high buildings and congested values demand their service, while hose carts will suffice for fighting ordinary fires in the residence section, the pressure and quantity of water available being adequate to throw very effective fire streams without the use of steam fire engines.

Contracts are now under construction covering about 135 miles of the new water distribution system.

The contract for pumping machinery was also let about a year ago to the Allis-Chalmers Company. This contract will include four 20,000,000 gallons vertical triple expansion crank and fly wheel pumping engines of the highest type; also one 20,000,000-gallon and three 40,000,000-gallon low lift centrifugal pumps, all driven by horizontal compound condensing engines and two direct connected generators similarly driven to operate cars, elevators, etc. There will also be 2,400 horse-power Heine water tube boilers, with automatic stokers. The cost of the above mechanical equipment will be about $500,000.

Bids have just been received for the construction of the water prification plants, one of 40,000,000 and one of 4,000,000 gallons nominal capacity, and the pumping station buildings, intakes and coal and coagulant handling equipment. The lowest bid for this contract amounted to $1,840,000. The time allowed for its completion under the contract is 28 months, with a "bonus and forfeit" clause of $200 per day as an incentive for rapid execution.

You will note that the "plural" is used in referring to "water purification plants, etc." The city is located on both sides of the Mississippi River and about 20,000 of the population live on the west bank in the "Fifth Municipal District," which is carefully "included" in the law which defines the duty of the Sewerage and Water Board, so that everything has to be duplicated on a small scale both in water, sewerage and drainage construction.

The proposed water purification plants are rather difficult of brief and satisfactory description. They are along the general line of modern plants of this character. Reservoir walls, filters, etc., are to be constructed of reinforced concrete, founded on piles for the most part, since the bearing power of the ground at New Orleans is usually assumed at not over 1,200 pounds per square foot.

Low lift pumps will take the water from the river through an intake, built at the low water line and arranged always to take water from the surface, through a level suction line laid with its top about 3 feet below ordinary low water level, and discharge it into the "head house," where its subsequent movements and the application of coagulant, etc., will be governed.

The ordinary course will be, first, through the grit chamber, where subsidence will eliminate any very heavy suspended matter, then via the head house through submerged orifices, which measure the quality passing and, by automatic connections, regulate all chemical feed in proportion to the quantity of water passing. At this point milk of lime is added and the water passes to and through the lime-mixing channels where it is kept in motion for another hour at a velocity sufficient to prevent subsidence and to effect such mixing and commingling of the milk of lime as will complete the required chemical action. While the water is still in the lime-mixing passages any soda necessary for the elimination of the contained sulphates is also added.

After an hour in the lime-mixing passages the water returns to the head house and is passed to the coagulating reservoirs, holding about seven hours' supply, where subsidence, due to the coagulating effect of the lime, is obtained and where additional coagulant (sulphate of iron) is added at such time or times and in such quantity as is necessary to produce a water properly prepared for filtration. Then again through the head house the water passes onto the filters.

The above is a continuous process with water constantly entering and leaving each department. Grit chambers, lime-mixing compartments and coagulating reservoirs are in duplicate, and a clean-out system of cast iron pipe, connected with an electrically-driven centrifugal pump, is placed under all parts of the system for the removal of the deposit formed. Roughly speaking, when the water consumption is 40,000,000 gallons per day the deposit in the reservoir should be enough in a year to fill four ordinary city squares about three feet deep.

In passing through the filters the flow of water will be automatically regulated between fixed limits, say from 3,000,000 to 6,000,000 gallons per filter unit (4,000,000 gallons would correspond to a rate of filtration of 125,000,000 gallons per day per acre), so that within these limits and by such gradual changes in rate as cannot effect the efficiency of the filters they will tend to respond to the demands of the distribution pumps, yielding at a high rate when the equalizing clear water reservoir beneath the filters (which is directly connected with the pump well) is low and at a low rate when it is high, the arrangement being such that each filter can be placed under this form of control or set to any required rate regardless of the height of water in the pump well. As a further guarantee that water will always be available in the pump well, covered clear water reservoirs, holding about six hours' supply, will be pumped full when the consumption is low, and connected to the pump well by a 48-inch pipe line and an automatic valve, which will open whenever the water in said well falls below a pre-determined level, thus admitting water freely from the clear water reservoirs to maintain the required minimum level in the pump well.

The investigation at New Orleans had indicated no particular advantage under local conditions in the use of air in connection with the wash water for cleaning the filters, even when the wash water was applied at only five times the rate of filtration, and experiments later at Cincinnati indicate that by doubling this wash water rate sufficient agitation of the sand layer is certainly obtained.

In accordance with these conclusions the provision for filter washing in New Orleans is to apply wash water at a very high rate, viz., 60 cubic feet per second, to a 4,000,000 gallon unit. In order to accomplish a portion of the wash at this rate without too great an increase in size of piping and strainer system, or too serious and sudden a draught upon the power in the boilers at the pumping station, it has been arranged to place two air-tight steel tanks above the filter gallery and to fill these tanks gradually from the distribution system. displacing the air in them through a check valve into a third tank placed above them, in which the air will be compressed to about 60 pounds pressure. This air pressure will then be applied to the wash water through a pressure-reducing valve, regulated to the pressure found necessary to produce the required initial wash water rate, the last or displacement stage of wash water application after the air pressure is exhausted being completed by the gravity head due to the elevation of the wash water tanks.

The development of water purification projects following the investigations at Louisville and Cincinnati in 1897 and 1898, where the first real studies were made of the combination of subsidence and chemical coagulation, with further subsidence as a preparation for effective and economical rapid filtration, has been considerable and appears to have been brought about in a most admirable manner.

The leaders in this work have been connected with numerous projects and have worked together for the advancement of the art, acting as it were as a "clearing house" to effect an interchange of all suggestions looking to improvement, preventing to a great extent any misdirected effort, and encouraging development along promising lines.

Through this "clearing house" we have seen some of the cruder ideas, which our preliminary studies at New Orleans developed, worked over, improved upon and tried out at other points, and when finally we were ready to push our plans to completion we were (through the courtesy of those in charge of various other somewhat similar works) enabled to get their complete plans and specifications.

Due to local conditions our general layout has no resemblance to any other similar project, and we have had no hesitation in departing in detail from the procedure of others whenever we have considered that an advantage could be gained. On the other hand, we have been equally willing to take every possible advantage of the "beaten path" where it seemed to lead most directly to the ends desired, and have found especially helpful the plans and specifications which we have had from Little Falls and Hackensack, New Jersey, and from Columbus and Cincinnati, Ohio, at each of which places large plants of a generally similar character have been or are now being constructed.

The general effect which the works now in progress must have upon the health and comfort of New Orleans are well illustrated by the following facts:

The Drainage System, adequate to handle ordinary storms as they fall and to keep the ordinary level of the water in the drainage canals down to from 10 to 15 feet below the ground level, went into operation in 1900, and immediately thereafter the death rate fell from 27 per 1,000 to 21.5 per 1,000, and has subsequently remained substantially at that figure, while thousands of acres which were formerly marshes are now dry and being built upon and improved.

Where sewers are being constructed in every street and kept pumped out the seepage or ground water flow collected into them amounts to over 1,000,000 gallons per square mile of area drained per day, and the effect of this under-drainage is very marked in the reduction of the saturation of the soil, and of the normal flow in street gutters. When the sewers are fully connected the dry weather flow in the street gutters will be practically eliminated, and the vaults and cesspools now existing all over the city will be a thing of the past.

With waterworks operation the cisterns at every house, and the existing muddy water supply, can be done away with and a pure water supply, under an adequate pressure, substituted.

All of these things will make for the health and comfort of the community, and there seems to be a fair prospect that the existing death rate of 21.5 per 1,000, which compares well with other large cities, can be still further decreased.

With cisterns, gutters and marshes furnishing breeding grounds for the various types of mosquitoes which each propagates, the eradication of the types of mosquitoes which are known to spread either yellow or malarial fever, when such fever is well introduced, has been a very difficult task, yet yellow fever, very strongly started last year, was stopped by a systematic oiling and screening of cisterns and oiling and salting of other standing waters.

The magnitude of such a mosquito campaign over an area of 33 square miles, with 800 miles of street gutters and 65,000 cisterns, many of them two or three story affairs, is obvious, and with our present knowledge of the advantages to be derived by the practical extinction of the Stegomyia and Annopheles mosquito, and the comfort at least arising from the removal of other types, the construction of Sewerage, Water and Drainage Systems in New Orleans would be warranted if this alone could be accomplished.

That these systems will be effective in this direction, as well as in a general sanitary improvement, is beyond any doubt, and it can be confidently predicted that the New Orleans of the next decade will deserve and have a sanitary reputation which will enable her not only to retain her present prosperity but to increase her rate of development in proportion to the magnificent opportunities which lie before her.

MR. HATTON: I move the thanks of this Society be extended to Mr. Earl for this very valuable paper.

Motion seconded and carried.

THE PRESIDENT: We will now have the pleasure of listening to Professor Kay, on the subject of "Chert Roads."

CHERT ROADS.

BY PROF. EDWD. S. KAY, TUSCALOOSA, ALA.

"Chert or flint is one of the hardest of rocks"; it does not usually occur in considerable quantities in its original beds, is everywhere mixed with more or less limestone or sandstone, so that beds of pure chert often grade imperceptibly into pure limestone or pure sandstone. Determinations made by the Department of Agriculture at Washington, Office of Public Roads-Division of Tests, give the following maximum and minimum results of some thirty samples, corrected to July 1, 1906:

Chert.	Maximum.	Minimum.	Average.
Specific gravity	2.90	2.00	2.50
Weight—Pounds per cubic foot	180	125	156
Water absorbed—Pounds per cubic foot	11.10	0.46	
Per cent. of wear	27.89	2.7	
French co-efficient of wear	14.6	1.4	
Hardness	19.6	19.1	
Toughness	21.0	7.0	
Cementing value—Dry	36.0	1.0	
Cementing value—Wet	106.0	5.0	

These tests made by the Government Office of Public Roads, show that chert exceeds in hardness any material ordinarily used for road building. The cementing valve tests of chert do not compare favorably with trap rock, limestones and other road materials, since the essential mineral of chert (which is quartz, a mineral of practically no cementing value) represents from 83 to 99 per cent. of the composition. However, the accessory and secondary minerals of chert, such as pyrite, magnetite, limonite, calcite, and chlorite have high cementing values, and cherts when used as road materials almost always increase in cementing value after being exposed to traffic.

Chert has a splintery or conchoidal fracture, and in color ranges from pure white to black, neutral grey, brown, yellow or red.

It is found in the Lower Carboniferous formation and in the Knox Dolomite of the Silurian or Cambrian. In the former it is generally in more or less regular beds or sheets; in the latter, usually in the form of concretionary masses. Geographically it is found in the sub-Carboniferous and Silurian outcrops in Alabama, and extending through the northeastern part of Mississippi, thence through Tennessee, following closely the Tennessee River through western Kentucky, crossing southern Illinois and Missouri, then down through the State of Arkansas and into Oklahoma The name of hornstone was more frequently employed for the same substance. In Illinois it is known sometimes as novaculite, but is unlike the true novaculites found in the hilly regions south of the Coal Measures in Arkansas from which the famous Arkansas whetstones are made.

There are extensive chert quarries in Alabama, near Florence, Ft. Payne, Birmingham, Leeds, Bessemer, Anniston, Jacksonville and other cities and towns. In the Birmingham District it is found in inexhaustible supply, overlying the red sandstone, which forms the covering for the big vein of red hematite ore and underlying the sub-carboniferous limestone. The chert of the sub-carboniferous formation, contains between the cleavage joints, a proportion of clay and iron oxide, and although the bank chert is sometimes comparatively soft until it is spread on the ground, it generally makes a better roadway than the hard material. In Alabama, the chert from the Silurian formation is harder and more expensive to quarry and does not make as good road material as that from the upper formation. All the cherts of Alabama are easily quarried, however, by blasting, and the lumps are reduced to proper size by napping hammers or by rolling. There is an extensive chert quarry in Tishomingo County, Miss., and in Alexander County, Illinois, at Elco, there is a chert bed about 150 feet in hickness. It is located on the Mobile & Ohio Railroad about 24 miles above Cairo. The chert is obtained by blasting, is run through a crusher and loaded on cars by the use of steam shovel. This chert besides being used as a road material, is used as ballast on the St. Louis division of the M. &'O. R. R. and to replace wooden platforms at stations. "Where cherts are found in banks or beds of streams, they are commonly called gravel. Creek gravel, formed from chert or novaculite, is usually of uniform size and comparatively clean, while the bank gravel often contains earthy matter and fine particles of the same material. The creek gravel usually wears the best, but it does not bind so readily, or form as smooth a surface as the bank deposits." These gravels are widely distributed over southwest Missouri and in Jasper County the cherty refuse from the zinc mines is utilized for road-making. In Arkansas the cherts (in place) are confined to the area lying north of the Boston Mountains and west of the Iron Mountain Railway. "There are two horizons at which it occurs in large quantities; the first is that of the Boone chert and cherty limestone lying at or near the base of the Carboniferous series of rocks; the second is the great chert beds lying far below the Boone chert, geologically speaking, and exposed in the counties through which the upper White River flows The Boone chert begins in Independence County, near Dota, and forms a belt of ragged edges from 5 to 15 miles wide, crossing the State from this point, past Cushman, Mountain View, Marshall, Harrison & Eureka Springs, and forming the greater part of the surface of Benton County. All through these chert regions the beds of the streams are filled in places to a depth of 15 feet with the accumulated small fragments of chert, most of which is in a suitable condition for immediate use for road building." The chert beds that occur in the Silurian rock of north Arkansas "crop out along the stream bluffs through Randolph, Sharp, Fulton, Izard and Baxter counties, and large quantities of the broken fragments accumulate in the beds of streams where they are often in excellent condition for road metal."

CHERT AS A ROAD-BUILDING MATERIAL.

Chert, as we have already noted, varies greatly in quality and appearance and upon exposure becomes hard and tough, offering a strong resistance to abrasion. The Alabama cherts which contain clay and iron oxide between the cleavage joints are easily and cheaply quarried, do not require crushing, bind together readily and make cheap roads that wear well and are smoother than roads built entirely of limestone. Mr. Sam C. Lancaster, Chief Engineer of the Madison County, Tenn., Good Roads Commission, commenting on Chert in his "Report on Road Building in Madison County, Tenn.," says: "This material seems to have been prepared in Nature's Laboratory especially for road building." Judged by the qualities required of an ideal road, we find this material to satisfy as many conditions, if not more, than any other material that is extensively used in road building.

It is low in first cost, as it is easily mined. The total cost on board cars at pits in the Birmingham District does not exceed 25 cents per cubic yard.

It requires no preparation, except breaking up of the larger masses, which is usually done by rolling or by napping hammers.

It is more durable than any form of dirt or macadam road.

It produces a road surface that is very smooth, of considerable elasticity, but hard enough to have a low tractive resistance.

A chert road does not rut under any condition of traffic. An examination of the highways in Jefferson County, Alabama, which have been built of chert and were constructed over twenty years ago, and many of them subject to heavy traffic, will show that these roads are still smooth and in good condition, although they have had practically no repairs.

Chert does not produce a slippery road surface, and it affords a good foothold to draw heavy loads.

It can be used on any grade. It makes a comparatively noiseless road and yields neither dust or mud.

It makes an impervious roadbed and being smooth drains rapidly.

Of light color, it does not absorb heat excessively. The color of the surface is pleasing and does not produce glare.

"Where the material is plentiful, and where a good quality of bank gravel is available for a binder it is not necessary to go to the trouble and expense of cutting out a sub-grade or to prepare earth shoulders as is done for regular macadam. It is, however, essential that the surface course contain a sufficient quantity of good binding material, otherwise the bond will soon be broken, the material will spread and much of it will eventually be forced or washed into the side ditches." John C. Branner in his Report on Road-Making Materials in Arkansas, says: "The 'ridge roads through all the chert regions of the state bear witness to the great value of this chert as a road-making material. These roads, though seldom or never repaired, are hard, compact, dry and free from mud and dust all year round. The gravelly roads on the hills about Eureka Springs are all of this Boone chert. The best roads in Benton, Carroll, Boone, Marion and Searcy counties are on this same formation."

METHODS OF CONSTRUCTION.

Mr. M. O. Eldridge, Chief of Records U. S. Office of Public Roads, in June number, 1906, of Good Roads Magazine, says: "The roadbed should be shaped with a road machine before the material is placed and given a slight crown of from 3/8 to 1/2 inch to the foot from the center to the sides. The foundation should then be rolled, the material for the first course spread in two layers and rolled and sprinkled in the usual manner. The spreading of the material can be accomplished by the use of a road machine, provided the gravel is not too large. The total depth may vary from 4 to 9 inches at the center, as soil and traffic may require, and gradually diminish in thickness to what is commonly called a 'feather edge' at the sides." "If the most approved method is followed, shoulders should be provided to hold the material in place. The material should then be spread to a uniform depth from the center to sides." During the year 1904 the Office of Public Roads built three chert roads in southwest Missouri, at Lebanon, Springfield and Neosho. A complete account of the Springfield road, giving methods and cost will be found in the Good Roads Magazine for April, 1906. The Neosho rock was easily broken by napping hammers or the steam roller and the Neosho road was built of uncrushed chert. The completed road, which was 12 feet wide and 2,640 feet long, contained 3,520 square yards of material and cost, including two culverts, 43 ctnts per square yard, or at the rate of $3.058.22 per mile. Total depth of the two courses of chert, consolidated, 7 inches. For full description of this road, see Good Roads Magazine, June, 1906.

A full description of the Madison County, Tenn., Chert roads, built under the direction of Mr. Sam Lancaster, will be found in the Yearbook of Department of Agriculture for 1904. Material for the Madison County roads was obtained in Alexander County, Ill. Solid foundations were first obtained by rolling. First course of stone put on 4 inches in thickness. The rolling was from the edges toward the center. Second course of finer material was put on 2 inches in thickness. The last course used being fine screenings, which was sprinkled and rolled until the whole is thoroughly compacted, having a thickness of 6 inches at the center and 4 inches at the sides. The cost of the chert per cubic yard delivered on cars at Jackson was about $1.60. The average cost of grading, preparing foundation, rolling, unloading stone, hauling it to the road, and laying it complete was $1,800.43 per mile.

CHERT ROADS IN ALABAMA.

A full description of the early methods of building chert roads in Jefferson County and Birmingham, Ala., will be found in Engineering News, Vol. XXX, No. 45, Page 370, by Julian Kendrick, City Engineer of Birmingham. Those roads were built without any attempt to conconsolidate the foundation or to compact the chert. There are probably over 200 miles of chert roads in Jefferson County with widths varying from 16 to 24 feet. In 1887 the Gate City Land Company cherted about a mile of street, which is a part of the county road system, and the road was extended in both directions, using the same material. Although there is a heavy traffic over this road as any in the country, and it has been in constant use for 19 years, with little or no repairs the road is still in good condition. The county roads were originally built by placing upon the sub-grade, limestone crushed to pass through a two-inch ring and spread 9 inches thick in center and 6 inches in thickness at the edges; over this was spread a layer of chert from 3 to 4 inches in thickness, which under traffic soon formed a smooth cemented roadway. The county has never owned a roller and none has been employed on any of the roads. The present practice is to place furnace slag upon the sub-grade which is crowned 6 inches at center and from 12 to 18 feet in width, the slag being put on 6 inches in thickness at center and about 4 and one-half inches at sides. Chert is then placed 4 inches in thickness at center and about 2 inches on sides. The City of Birmingham has about 40 miles of chert streets or roads. Some of these streets were built by simply forming the natural material of the street and compacting it with a steam roller. The roller used by the city weighs 15 tons, weight on each 20-inch wheel 6 feet in diameter, being 5 tons. On all cherted streets a foundation course of slag is placed on the well compacted sub-grade. The slag delivered and rolled costs 80 cents per cubic yard, put on 4 inches in thickness or nine cents per square yard. The chert costs from seventy-five cents to one dollar and twenty-five cents per cubic yard on street in place and rolled. It is spread on an average to a thickness of five inches in center and decreased to three inches at sides and rolled until smooth and compact. The center rise or crown, where chert is used at Birmingham, is about one-thirtieth of the width of street measured from outside of gutters. Gutters are three feet wide measured from outside edge of curb. On grades, a little in excess of one-thirtieth of street is used to determine center rise. There are streets in Birmingham with grades as high as fifteen per cent., on which this material has been placed.

The chert now being used at Birmingham comes from banks near Bessemer. It costs about sixty cents per ton f. o. b. cars Birmingham, including freight charge of twenty-five cents per ton, and weighs about twenty-eight hundred pounds per cubic yard on cars.

In Jefferson County where slag is not available, the foundation course is made of the harder and courser portions of the chert used and placed from four to five inches thick; the top course being the same as where slag is employed for a foundation.

At Cairo, Illinois, the Elco chert was used on Commercial Avenue, the chief business street, on a sand foundation—thickness of chert compacted about eight inches. It has been placed for a number of years and the street is still in excellent condition. Eighth Street in the same city was improved by placing a six-inch course of uncrushed chert on the sand foundation and a two-inch top course of chert crushed to pass a three-quarters inch mesh. This street after four years' use is smooth and in excellent condition.

THE PRESIDENT: We will now have the pleasure of listening to the report of the Committee on Waterworks and Water Supply, by Mr. Julian Griggs, and also a paper entitled "The Cost of Clearing and Grubbing a Reservoir Site," by same member.

REPORT OF THE COMMITTEE ON WATERWORKS AND WATER SUPPLY.

By JULIAN GRIGGS, CHAIRMAN, CONSULTING ENGINEER, COLUMBUS, OHIO.

In noting the signs of the times in the matters of water supply and waterworks your committee sees no diminution of the trend toward public as against private ownership of these utilities which has been so decided in recent years. Doubtless an array of statistics to show this trend by tables or by curves would be of some interest to the engineering profession, but the committee have gathered no such data; it has been contended with listing a few of the obvious tendencies of the present for the purpose of marking time, which is one of the functions of our convention.

During the year committees have been appointed from many of the state and local engineering societies and clubs of the middle west for action in common looking to a prevention of stream pollution. Not much can be said as yet to have been accomplished, but as betterments are dependent on the growth of an approving public opinion which is necessarily slow in forming the co-operation of many influential societies as noted is a distinct gain, which will tend to greatly hasten an improvement in the sanitary condition of our streams. A reform desirable from sentiments of cleanliness and decency, but also as a matter of public health, because with the rapid increase of population in our cities, surface waters from the rivers and streams must in the future be more and more utilized for municipal water supplies.

The general government is continuing important and useful work in the records of stream discharge and turbidity, to which has been added studies by specialists on the underground sources of supply in various sections. These underground sources are important, generally the cheapest in development, and most satisfactory for the smaller communities.

FILTRATION.

It will not be amiss to mention the large cities of America having plants for water filtration either in course of construction or recently completed. They are Louisville, Ky., Cincinnati and Columbus, O., Pittsburg, Harrisburg and Philadelphia, Pa., Washington, D. C., Providence, R. I., and New Orleans, La. And there should be added some works by private water companies, such as the East Jersey, Hackensack and New Haven companies with an aggregate normal daily capacity of 68 million gallons, supplying the cities of Paterson, Passaic, West Hoboken and Millville, together with a number of smaller communities in Northern New Jersey, and New Haven, Connecticut.

Very large sums of money have been and are being expended for the purification works listed, generally under adequate plans and with competent engineering direction. The number of cities to engage in similar undertakings in the near future is believed to be great, and the specialists now engaged in this line of work or in training for it are likely to have a busy time.

WATER SOFTENING PLANT.

There is said to be but one municipal water softening plant in the United States—located at Oberlin, Ohio, a village of about 4,000 people, requiring 165,000 gallons of softened water per day, and only three such in the world. The largest is at Southampton, England, a city of some 70,000 population, with works of four millon gallons daily capacity, in operation since 1888, and the other at Winnipeg, Manitoba, a three million gallon plant which went into commission in 1901.

It is perhaps not surprising that municipalities have not been more progressive in softening their waters for the reason that the sanitary cleanliness of a city water supply is of vastly more importance than the economic gains to be had from a soft water and our cities have been very slow to perceive and follow their duty even with respect to the former.

VALUE OF SOFT WATER.

It is surprising that our railway companies have only in recent years awakened to a realization of the advantages of a soft water for use in locomotive boilers, considering how they were daily forced to meet the losses due to hard unsuitable waters, although the softening process had been known for half a century. The railway companies have, however, in recent years been calling into their service many young men from our universities who have been trained to think, and to this fact may be due more than has heretofore been acknowledged the improvement noted in railway practice.

ILLUSTRATING THE SAVING.

An anecdote here will illustrate the point to be emphasized. It concerns a woolen factory said to have been located somewhere in Michigan. For years the proprietor used in washing his wool an extremely hard surface water, but presently, for the comfort of his operatives, developed an artesian supply which proved cool, abundant and soft. He, however, continued to wash his wool with the hard surface water until some bright commercial traveler, in passing through the works, suggested the obvious change in method, which, when made, in a few months saved, in cost of soap required enough to pay the whole expense of drilling the well and a considerable sum in addition. The commercial traveler afterwards, in relating his observation and experience as above outlined, was asked by some listener, how he accounted for the obtuseness of the manufacturer, to which he replied, "Oh, he was one of those western hustlers and didn't have time to think."

TECHNICAL GRADUATE.

It may be noted as a promising sign of the times that in the management and operation of our water works the technical graduate is increasingly in evidence, that he has been trained to take time to think and this sign is a harbinger of good for the future of municipal water works development.

THE COST OF CLEARING AND GRUBBING A RESERVOIR SITE.

BY JULIAN GRIGGS, COLUMBUS, OHIO.

In this paper it will be the purpose of the writer to give with some detail the cost of clearing and grubbing the site of the reservoir formed by the construction of the Scioto River Storage Dam for the municipal water supply for the City of Columbus, Ohio.

The work to be described was but a small portion of the total expenditure of about $700,000 by the city for the dam and works appurtenant thereto, but the failure of the writer after a somewhat extended search of engineering literature to find descriptions of this portion of similar undertakings has led to the hope that a paper on the cost of clearing and grubbing a reservoir site will prove a welcome, though slight contribution to the subject of water supply engineering.

Cases of complete soil removal, as in the Wachusett reservoir for the Boston Metropolitan Water System, are not unknown; perhaps, however, it has never before covered so large an area and been done with quite the degree of thoroughness which there obtained, but wherever done, it is for the engineer mainly a question of estimating the cost of excavating and hauling a given quantity of earth, while the clearing and grubbing become a secondary matter as tending only to increase slightly the cost per cubic yard for excavating and removing the earth to a point outside of the reservoir.

In the Columbus case the usual conditions were reversed for the reason that the Scioto River is normally a muddy western silt bearing stream with a drainage area of 1,032 square miles above the dam and a flood discharge approximating a maxim of 50,000 cubic feet per second.

The relation of reservoir capacity to maximum stream discharge is such that the reservoir at maximum flood flow would fill and empty twenty times in twenty-four hours. It is therefore expected that silt in material amounts will be deposited in the reservoir at every considerable rise of the river and under these conditions it was not deemed necessary to remove any of the surface soil except to a very limited extent around former human habitations within the submerged area, but responsive to the requirements of the Ohio State Board of Health all vegetable growths were cut down even with the ground, being then gathered into heaps and burned, while the stumps and roots of all trees and shrubs one inch or more in diameter were grubbed to a depth of one foot below the surface and similarly gathered and burned.

The reservoir is unique in its way by being unusually long, 5 8-10 miles, for its width, which varies between 200 and 820 feet, and averages only 504 feet at the water surface with reservoir full. The river in ancient times wore out a gorge in the limestone rock of the Upper Hilderberg formation some ninety feet below the general level for a width of from 600 to 800 feet, and in more recent times has filled it in again with rich alluvial deposits to a depth of about 18 feet, through which the present stream with a descent of five or six feet per mile has cut its slightly meandering channel ten to twelve feet in depth and about 200 feet in width.

In places on either side of the gorge vertical bluffs twenty to thirty feet high for perhaps a total length, within the reservoir limits, of two miles still remain, but generally speaking the rocks forming the sides of the gorge have crumbled and now appear as steeply sloping hill sides too rugged for cultivation and for the most part covered with trees and shrubs.

From the above description it will be seen that the reservoir formed by the dam, which has a height of 33 feet from its apron to its rollway, will fill the gorge at its lower or south end 720 feet in width and only the present river channel 200 feet in width at its upper or northern end. The greatest depth of water in the reservoir is 35 feet and the mean depth is 14 feet or 40 per cent of the maximum. The area of the river at ordinary low water within the reservoir was 125 7-10 acres, while the water surface of the reservoir at the elevation of the rollway is 351 acres.

A portion of the bottom land for an aggregate area of about 36 acres had been cultivated before it was purchased by the city, but the remainder was thickly covered with a growth of trees and shrubs common to the forests or groves of this locality and consisted mainly of elm, oak, beech, hickory, maple, buckeye, locust and sycamore, the latter especially growing to large proportions, some of them being five feet in diameter. The shrubs were mostly osage orange, willow and pawpaw and smaller growths of the trees above mentioned. The bottom lands were very fertile and everywhere in addition to the trees supported a rank growth of weeds, among which horse cane (Ambrosia trifida) predominated, growing to a height of eight to thirteen feet.

The area to be cleared and grubbed consisted then of two strips of land, one on each side of the river together with a number of densely wooded islands aggregating a total of 255 6-10 acres, 5 2-10 acres being below the site of the dam cleared but not grubbed. The outside boundary of the clearing was contour 75 feet, which was two feet above the crest of the rollway of the dam.

The base of levels was city datum on an assumed plane 100 feet below the water table of the Ohio State Capitol.

The dam, and the beginning, or south end of the reservoir, is 7½ miles northwest from the center of the city and is now reached by trolley cars with an hourly service.

Bids for the grubbing and clearing (Contract No. 3 improved water supply for Columbus, Ohio) were received by the Board of Public Service on the 11th day of May, 1904, and varied from $70 to $155 per acre on an estimated area of 270 acres, as shown more specifically in the following table, the totals ranging from $18,900 to $41,850:

Name of Bidder.	Estimated Area of Clearing and Grubbing.	Rate per Acre.	Total Bid.
Hoover & Kinnear....	270 Acres	$70 00	$18,900 00
John H. Clutter......	270 Acres	149 50	40,365 00
Fisher & Knight......	270 Acres	155 00	41,850 00

The proposal of Messrs. Hoover & Kinnear, of Columbus, Ohio, was accepted and a contract with them was executed June 6th. Work was begun on June 14, 1904, and carried on continuously until completed, April 5, 1905.

The method adopted by the contractors in doing their work was divided into three and at times into four operations.

First a gang called the "Trimming Gang," consisting of from four to twenty laborers, equipped with axes and grubbing hoes, under the direction of a foreman, trimmed the limbs from the larger trees as high as they could reach, cut off the smaller trees about two feet above the ground, grubbed out the brush and roots and gathered into piles everything that could be burned.

Second the Trimming Gang was followed by a "Pulling Gang," composed of from six to twelve laborers, a team of horses and a stump puller. Their work was to pull up the trees and stumps. Some of the time the same gang and at other times a third gang (third operation) cut the trees and stumps into pieces that could be readily handled, grubbed out the exposed roots and piled the whole for burning, excepting such portion of trees as were saved for saw logs.

When the work began it was thought necessary to partly season and dry the brush and wood by several weeks exposure before burning, but during the winter it was found practicable to burn everything as soon as it was cut and piled.

The stump puller used was the type known as the "Hawkeye Stump Puller," and consisted of a vertical iron windlass, operated by a team of two horses. The bed to which the end of the spindle of the drum was secured, was formed of two pieces of oak timber each 10 by 12 inches by 16 feet in length, framed into a cross with equal arms. The drum was thirteen inches in diameter and two feet in height. The spindle above the top of the drum was secured by four legs, made of iron pipe, inclined outward at an angle of about 45 degrees. At the lower ends the legs were tied together with an iron strap to prevent spreading and each was fastened to an arm of the timber bed. To the end of the spindle projecting above the legs was secured one end of an 8 by 8-inch oak timber; to the other end was hitched a pair of horses making a sweep of 20 feet radius. Dragging from this sweep, directly back of the team was a stiff stick, the end upon the ground shod with an iron point, the purpose being to hold the strain made by the sweep when the horses were standing or when taken away. With each machine there were two pieces of ⅞-inch wire cable about 100 feet in length, hooks, grips, blocks, snatch cables and so forth. Four of these machines were in use by the contractors.

In operation the timber bed was buried in the ground and to make it secure, iron pins were driven into the ground against the sides of the timbers, or the timbers were loaded with stone. The snatch cable was usually fastened around the tree to be pulled from ten to twenty feet above the ground. The cable was usually passed through a snatch block fastened to a tree near the stump puller so as to bring it into a horizontal position as it was wound upon the drum. If the tree was too firmly rooted to be moved when the strain was applied, sometimes a part of the roots were cut, but usually it was the practice to explode a charge of dynamite among the roots without releasing the strain from the stump puller. Stumps, of which there were large numbers, were harder to pull than the trees and most of them had to be broken up with dynamite and taken out in pieces. Many of the trees had roots at a considerable distance below the surface of the ground, probably due to the gradual accumulation of earth above them since the trees began to grow. Large quantities of dynamite were used. It is said that sixty sticks were exploded in removing one stump.

Fourth Operation: After the trees had been pulled and burned the ground was all gone over during the months of March and April, all loose pieces of wood were picked up, any grubbing previously overlooked was done and the grass and weeds burned.

The common harrow was found to be the best tool for breaking down and gathering the weeds. It is estimated that 3,000 saw logs were sold by the contractors at $2.50 per 1,000 feet board measure and there would have been many more if the trees had not been shattered by exploding dynamite.

The table of costs which follows is derived from the inspector's daily reports, and is believed to be fairly accurate. It shows a total cost of $40,766.75. Common labor was paid $1.50 per day of ten hours and is the largest item of cost, being 53 3-10 per cent. of the total. The next largest item is dynamite, 19 1-10 per cent, followed by foremen, 8 2-10 per cent., and horses, 8 1-10 per cent.; machinery, 4 4-10 per cent.; accounted for all but a remainder of 6 9-10 pr cent., which is divided among superintendent, dynamite men, time-keepers, blacksmith and carpenter. The cost per acre therefore for the work done was $159.50.

Item.	Days.	Rate.	Total.	Per Cent. of Cost.
Superintendent	255	$4.16⅔	$1,062.50	2.6
Time-keepers	255	1.75	446.00	1.1
Foremen	1,030	2.50	3,325.00	8.2
Blacksmith	205	2.00	410.00	1.0
Carpenter	54	2.00	108.00	.3
Dynamite-men	435	1.75	761.25	1.9
Laborers	14,491	1.50	21,736.50	53.3
Single horse	222	1.50	333.00	.8
Two-horse team	847	3.50	2,964.50	7.3
Dynamite	68,000 lbs.	.11½	7,820.00	19.1
Machinery and repairs			1,800.00	4.4
Total cost			$40,766.75	100.00

Cost, per acre, $159.50.

The final estimate given May 17, 1905, was for 255 6-10 acres at $70, $17,892.

In addition to the above there was paid to the contractors $1,685.10 for doing work outside of the contract, the following amounts being cost to contractors with 15 per cent. added for use of tools and profits.

Building guard fences along public highways at dangerous places	$230.48
Removing trees and stumps from the river	283.75
Clearing the city's land above contour 75 feet	1,157.51
Miscellaneous work	13.36
Total	$1,685.10

The season was unusually favorable for the prosecution of the work as there were no delays and very little additional expense incurred by reason of high water.

The foregoing table indicates that the contractors lost a comparatively large sum of money in the execution of their contract but they never showed any disposition to slight the work or endeavored in any way to diminish to their advantage the amount thereof, neither did they permit the work to drag along, as not infrequently happens under such conditions, but prosecuted with energy and completed the same within the time limits of their contract obligation, for which honest endeavor they are entitled to and should receive great credit.

ENGINEERING.

Prior to the beginning of the work by the contractors a line of levels was run on each side of the river and stakes set to indicate on the ground the position of contour 75 feet. These stakes were set as often as there was a change in the direction of the contour and were from 50 to 400 feet apart. As an aid to finding them again they were numbered consecutively from the dam. To check the work the two lines of levels were connected at intervals of about a mile.

After the land had been cleared, survey lines were run one on each side of the valley near contour 75 feet, and the contour stakes previously placed were located by right and left measurements. Survey lines were also run on each side of the river from which the shore line of the stream was similarly located and to check the work all of the survey lines were tied together at intervals of about a mile. Contour 73 feet was also run and a careful observation made to be sure that no grubbing had been omited below that elevation. All survey lines were then platted and the areas having been computed by latitudes and departures were checked by planimeter measurement on the plats which were made to a scale of one inch equal to one hundred feet.

ADDITIONAL WEED CUTTING AND BURNING.

In May, 1905, the site of the reservoir was practically cleared of all vegetation and ready to be filled which by the requirement of Contract No. 1, for the dam was to have begun by the middle of that month. The work on Contract No. 1 had not been prosecuted at the rate stipulated in the specifications and was further delayed during the summer so that by the middle of August the whole reservoir site was covered with a luxuriant growth of weeds, some of which measured thirteen feet in height, and it became necessary to remove them before the reservoir could be filled.

An unsuccessful effort had been made the previous season to burn the dead weeds as they stood upon the ground. Neither would they burn when broken down. The city therefore engaged a foreman with a gang of seven Italian laborers to cut the weeds and after they had sun dried, to gather into piles and burn them. This work began August 21, 1905, and was continued until water was running over the completed crest of the dam on the 6th of the following December.

Where possible a horse rake was used in gathering the weeds but where the surface could not be raked manure forks were used for this purpose.

Shortly prior to December 6th a day was fixed for dedicating the dam and it was then determined to fill the reservoir as speedily as possible. A large gang of extra men with tents and supplies were sent to the reservoir to rapidly complete the weed cutting and cleaning then being prosecuted by the city foreman and his small gang.

The cost to the city of the work so done between August 21 and December 5, 1905, was $1,969, divided into labor, tools and supplies, as shown in table following:

Item.	Labor.	Tools and Supplies.	Total.
Small Gang.................	$1,210.13	$43.50	$1,253.63
Large Gang.................	428.78	286.66	715.44
Total...........	$1,638.91	$330.16	$1,969.07

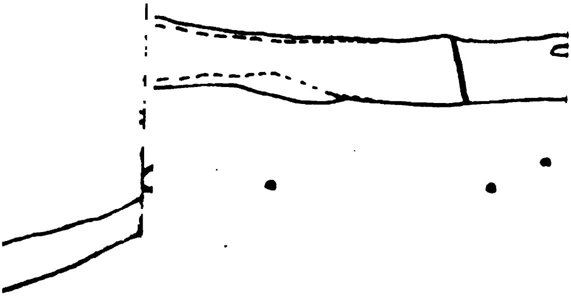
It will be seen then that for clearing and grubbing of a reservoir site under the conditions which obtained in the work herein described and neglecting the general expense of the contractors the cost with common labor at 15 cents per hour, may be reckoned at $159.50 per acre, to which there may be added for extra work required a further cost of $6.73 per acre. And if the reservoir is allowed to grow up with weeds and needs to be again cleaned the added cost will be $7.86 per acre or a total for all work done of $174.09 per acre for the area covered. in which is included none of the cost of engineering and inspection.

For the very efficient supervision of the execution of this contract and the carefully prepared cost records and description as stated in the foregoing paper, I am indebted to Mr. F. B. Edwards, resident engineer in charge of the work under the direction of the writer, as Chief Engineer of the Board of Public Service of the City of Columbus, Ohio.

A map of the reservoir to a scale of one inch equal one thousand feet accompanies this paper.

THE PRESIDENT: This paper is now open for discussion.

MR. SHERRERD: Having on several occasions been a member of the Committee on Water Works and Water Supplies of this Association, and knowing the difficulty of getting a paper that would be of general interest on this subject from the membership of Society, which to a great extent has been more interested in pavements and sewerage questions, it seems to me that the Society owes a good deal to the present chairman of this committee for



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the able papers that have been presented on this subject. In connection with the preparation of reservoirs, this one item of grubbing and clearing has been one which the contractors, I think, have always found a difficulty in estimating, and I think that one of the functions of this Society has been very well served by the able paper which has just been read, because it will give a basis on which work of this kind can be computed. The chairman also presented a paper on another subject of the water supply problem, which is of particular interest to me in its reference to the water treating problem; I think, however, that the paper omitted to mention one of the principal plants, for this purpose, which is now under construction at Reading, Pa. This problem of treating the waters in order to make them useful for domestic purposes where they are particularly hard, is one which has only been given attention during the last few years. I know in one case where the question of the hardness of the water may perhaps be considered as an element in the value of the plant; some of the experts in the case have figured out that the value of a soft water as compared with a hard water is equal to ten cents per point per million gallons, and in this particular instance where the hardness of two relative waters which were available differed by ten points and another by 110 points. He considered that the softer water was worth $11.00 per million gallons more to that city or to a city, than the hard water. I am rather inclined to differ with the scale of comparison, but I think we ought to feel that some relative comparison in dollars and cents is applicable to such a situation. The degree of hardness may perhaps be better measured by the kind of consumption to which the water is put; that is, if it is a manufacturing city, where the hardness is a material element, and where a large quantity of water is used, in the laundry business, for instance, or in some other manufacturing pursuits, where the element so enters materially, then it is a proposition more important to consider the dollars and cents point of view in connection with the comparison of those waters. But, there is also another element to be considered, and in this case to which I refer, the element did enter into the construction of the case; that is, the water that had only been used was one which formed rather hard scales on the boiler, and the same reason supplied while harder to a degree of 110 points than one which formed a soft deposit on the boiler and could be blown off, in point of fact the results were more advantagegous for those he had occasion to use the harder water in boilers, than for those who had formerly used the softer water. I would also like to refer to a case that may be of interest in connection with the effect of sulphur more particularly on the seviceability of waters, to a condition which was brought to my attention some two years ago, where a railroad had an extended store yard which was used for the making up of freight trains. In the early years of the use of this yard, the company had been in the habit of getting their water supply from an underground source, which was the accumulation of the water which fell under their limited area as to freight business and coal business and the storage of cars in this yard, and also the storage of coal, which you will know is now being carried on by almost all of the railroads who center around the metropolitan district, increased the rain flow which came down on these yards a greater amount of sulphur into the ground water to such a degree that it became absolutely necessary for the railroad to abandon their previous water supply and resort to some other supply over the territory which was not impregnated with this sulphur. I mention this case because I think perhaps many members of this Society may have run into the same condition, and that it is always advisable to take into account the changes of local conditions which may affect the water supply. (Applause.)

The President: Any other discussion?

Mr. Crandall: It may be of interest to the members of this Society to know that a brewing company in the City of Dayton, Ohio, where the water supply is exceedingly limited, as most of us know, found it necessary to provide some means for getting the lime out of the water, and the proprietor devised a system of his own, which simply consisted in raising the temperature of the water to just the required degree in boiling point to cause the lime to settle on the pipes that extended along about fifty feet; the water run in the tube in thirty pipes through which the steam run, raising the temperature of the water, so that the lime would be deposited on the pipe, run out a little sluice-way and that sluice-way was provided with stone, and the lime deposited on the stone, and could be pushed away. The lime was extracted from the water by that process, and after reaching the vat in the other room, it was put through some process by which nearly all the lime was extracted. The water was sold at so much per barrel; sold as white rock is being sold, and as pure spring water is sold, and it was a profitable investment. I visited this plant some years ago, and it was a very interesting thing.

THE PRESIDENT: If there is no further discussion, we have other business to take up.

THE SECRETARY: Mr. President, I would like to bring up the amendment to the Constitution. That is, to amend Section 1 of Article 7, so that the meeting of the Society should be held on the second Tuesday in October, instead of the second Wednesday in October, and I would like to move the adoption of that amendment. Seconded and carried.

MR. RUST: I have a resolution here the adoption of which I wish to move; it was omitted last evening; can I bring it up now?

THE PRESIDENT: Yes, sir.

MR. RUST:

Resolved, That the Secretary be instructed to extend to the American Civic Association and the National Municipal League invitations to hold their conventions for 1907 at the same time and place as this Society, and that he be authorized to make the necessary arrangements in conjunction with the local committee in case these invitations are accepted.

THE PRESIDENT: Any discussion of this motion, gentlemen?

MR. REIMER: Mr. Chairman, I was present at the meeting of the Municipal League in Chicago and know that they voted to go to Norfolk for their convention. Is it not superfluous for us to invite them to meet with us next year?

THE PRESIDENT: That was the American Municipal League?

MR. REIMER: Yes, sir.

THE PRESIDENT: The invitation is to the National Municipal League. Any further discussions?

MR. REIMER: It is not exactly a discussion, but I would like to say for Mr. Rust, and probably other Past Presidents, that the Civic League and some other societies working along the line of municipal improvements in various directions, have for several years been trying to co-operate with this Society in some line or another, I think. Although the Society has never in the past felt like any intimate association with the other society, it does seem to me that it would be a very good plan for us at least to meet in the same place and get acquainted with each other, and possibly that would be the best opportunity to give the subject some more consideration and thought, which has not at all been done in the past. I do not think any more intimate connection with the Societies would help us, but would not hurt us any.

A MEMBER: Michigan has a league of municipalities which has no connection whatever with the national organization,—it is made up of mayors, heads of departments, city engineers and aldermen of the leading cities of Michigan. I have known of its work for several years, and it struck me that if we could get them to meet with us at the same time, without in any wise affecting our organization, it would make the meeting more successful. If the mover of the resolution would accept the amendment. I would move that it include the League of Michigan Municipalities.

THE PRESIDENT: The Chairman may suggest that it would be to the effect—that while an invitation to these two societies would be something different to the League of Michigan Municipalities. One may lead to the meeting together or in the same place, while the League of Michigan Municipalities would be only for the one meeting in Michigan, and my suggestion would be that the matter be left with the Executive Committee as to the invitation to the League of Michigan Municipalities.

Mr. Davis: That league always meets in the spring, in February or March, and it would be useless to consider the changing of the meeting of that society, as it always meets at that time.

The President: If there is no further discussion, all those in favor of the motion make it known by the usual sign, those opposed, no. Carried.

Mr. Sherrerd: May I now bring up the matter referred to in the report of the Committe on Fire Protection,—I would like to offer the following resolution:

Whereas, The following associations, namely, the: National Board of Fire Underwriters, National Fire Protection Association, International Association of Fire Engineers, North Carolina State Firemen's Association, National Firemen's Association, New England Water Works Association, Penna. Water Works Association, and the American Water Works Association, have approved of a standard thread for hose couplings, hydrant nozzles and other standards in the interest of a more uniform fire protection service; therefore, be it

Resolved, That the American Society of Municipal Improvements hereby recommend the adoption of a standard thread for fire hose coupling and hydrant nozzles of 7½ threads to the inch on a male coupling or hydrant nozzle of 2½ inches internal diameter and an outside diameter of 3 1-16 inches and the necessary details essential for the guidance of manufacturers; be it further

Resolved, That this Society recommend that in general minimum size of hydrant connections be not less than six (6) inches in size; and be it further

Resolved, That the top circumference of hydrants bear in raised letters in a suitable place surrounding the operating nut an arrow at least 2½ inches long and the word "open" in letters at least ¾ inches in height, and that hydrants open to the left, but that all hydrants in each city open in the same direction

Mr. Sherrerd: I move the adoption of that resolution.

Mr. Reimer: I would like to ask one question. Mr. Sherrerd's figures provide that no hydrant connections should be made with less than 6-inch pipes, and 6-inch pump connection with hydrants. In some of our cities four-inch pipes are laid, and we realize possibly that that should not be, but they are there, and the question that arises in my mind is whether that could apply.

Mr. Sherrerd: This is only offered as a standard. I believe it is advisabe for an association like this to get in line with the other national associations. The matter was seriously considered by the American Water Works Association, and it was believed that while such a recommendation was somewhat radical in its nature, yet the importance that the insurance people are attaching to the improvements of water supplies for fire protection purposes, made it essential that that association at least should put itself upon record as establishing some criterion by which a superintendent of a water plant might know what he was expected to do; and the reason I offer this resolution and ask its adoption by this Association for 6-inch pump connections to hydrants is because the Committee of Twenty of the National Fire Protection Associations, which has been making examinations of many of the larger cities in the country have made very extreme recommendations, and their recommendation is in the line that no hydrant should be supplied with less than 8-inch connection, and all hydrants in the business sections of a city be 12 inches at least, and their recommendation was so radical that it seemed somewhat essential that some measure that should be expected from the cities should be adopted by the national association.

Mr. Folwell: It seems that the two propositions made here can be offered on entirely different grounds; the matter of the 6-inch connection based on fire hydrants is something which in one town has no effect whatever on any other town; if one town wants to put in 4-inch hydrant connections, it is its own business, and effects nobody but their town; and if the insurance companies are going to put up the insurance on account of the 4-inch connections, the merchants will have to stand the raise. Where you go to make a standard nozzle connection, that is something different; if this town had a four-inch hydrant connection, that's no reason why this town should not send their hose and apparatus to a neighboring town and assist that town and leave the 4-inch hydrant connection at home; it does not effect the other town at all; and if the 6-inch or 8-inch hydrant connection is called for it means at least a 6 or 8-inch pipe in the street. I am in favor of a standard hose nozzle connection, but I am not in favor of dictating what the pipe system of a town should be.

MR. MCCARTIN: I am in favor of the motion of Mr. Sherrerd. It seems that Birmingham is going to considerable expense in changing 4-inch connections to 6-inch connections, and it is some interest to this town as to what is done in the matter of fire protection in other towns. We have seen our insurance rates raised in this town after fires taking place in other towns, and it effects us pretty severely here. You can't get water through a 4-inch pipe to put out a large fire in the business portion of the city, and the sooner all the cities get supplied with first-class engines and hydrants the sooner the insurance companies would reduce their rates in the different cities; one city would not have to pay so much more than another city. I think that is a good resolution.

MR. HOWARD: I regard this as suggestive and educational; we are not passing laws here, but what Mr. Sherrerd discloses is exactly in line as I interpret it, and I am heartily in favor of adopting his resolution into it.

THE PRESIDENT: If there is no further discussion, all in favor of the resolution make it known by the usual sign; those opposed, no. It is carried.

THE PRESIDENT: We have the report of the Treasurer and the Secretary will read it.

REPORT OF TREASURER.

OSWEGO, N. Y., Oct. 1, 1906.

RECEIPTS.

Balance on hand last report	$ 721 92	
Received from G. W. Tillson, Sec.	1,110 65	
		$1,832 57

DISBURSEMENTS.

1905.			
Sept.	4.	G. W. Tillson Sec., 1904-1905	$ 200 00
	14.	A. P. Folwell	54 98
	14.	J. H. Kenehan	55 00
	14.	J. W. Ritchie	5 00
	27.	A. P. Folwell	6 00

1906.				
May	8.	S. E. Tate Co., printing	405 43	
		Bills paid in Montreal.		
		Alcide Chausse, help	5 00	
		Alcide Chausse, expense to New York	32 00	
		Charles C. Brown, expense	14 06	
		J. W. Ritchie & Co., exhibits	195 00	
		John W. Barlow, expense to New York	27 50	
		H. J. Beeman, lecturer	10 00	
		Guertin Printing Co., printing	20 00	
		F. J. O'Brien, expense treas. office	5 00	
		Exchange on checks	3 60	
		Balance this date	794 00	
				$1,832 57

F. J. O'BRIEN, *Treas.*

Approved.

AUGUSTUS F. EGGERS,
FERD. GIDDINGS,
Finance Committee.

THE SECRETARY: I have a paper, Mr. President, on Street Lighting, "Electric Street Lighting," by Mr. Jno. I. Mange, Manager of the Watertown Light and Power Co. I suggest we read it by title.

The following paper was then read by title:

NOTES ON STREET LIGHTING.

BY J. I. MANGE, MANAGER WATERTOWN LIGHT AND POWER CO., WATERTOWN, N. Y.

A special and very important department of lighting has to do with streets and other outdoor spaces. It involves not a few unusual difficulties, for there is unlimited space to deal with as well as an indefinite variety of natural and artificial constructions, and save in narrow streets bordered by high buildings, one gains little or nothing from the diffusion that is so important a factor in interior lighting; and in many instances the streets are so thickly shaded by trees that the problem of adequate lighting is very difficult and one for which local data is necessary for its solution, if it is to be done properly.

The amount and distribution of streets and the needs and distribution of the population are the controlling factors in the matter and obviously these vary greatly from place to place.

It is interesting to note that it is now about twenty-five years since the electric arc was first applied to street lighting and it has proven itself to be really the only source of light profitable to consider.

The incandescent lamp is by no means to be thought unfit for service, as many of them are now doing admirable work in small towns, in suburbs of cities and in many blind alleys and courts where the expense of an arc lamp is unnecessary. However, at the same total cost, the arc lamp gives a considerably higher average illumination and experience shows that on the whole, arcs which have to be inspected at frequent intervals for the purpose of trimming are kept nearer their point of maximum efficiency than incandescents.

In streets where shade trees hang very low. and the foliage is very heavy, arc lamps are at a great disadvantage. Here as well as in many other places where there is no real need of a brilliant light, the incandescent is capable of doing good service at a moderate cost. Economy also sometimes dictates caution in the expenditure for street lighting and in most cases recourse can be had to the incandescent.

The incandescent lamp is usually fifty, seventy-five or one hundred candle power when operated in series with the arc lamps, and sixteen, twenty-five or thirty-two candle power when worked in series upon an alternating current circuit of one thousand or two thousand volts, taking two or four amperes. It should be noted, however, that lamps so operated are costly in the matter of renewals and difficult to operate satisfactory.

In view of the rapid deterioration of the brilliancy of the incandescent, it is not wise to space them over one hundred and twenty-five feet apart for good service; although in heavily shaded streets if one hundred candle power lamps are used and placed on alternate sides of the street, the space between consecutive lights may be three hundred feet and still produce a fairly well lighted street.

This makes the first cost of installation rather high and therefore the cost per year to the city is higher, relatively, than the arc lamp. For a fifty-candle power lamp, the average price is twenty-five to thirty dollars per year.

Gas lamps have been used with considerable success much in the same manner as incandescent electric lamps are used. The old style open flame lamp was a very wasteful one burning eight or twelve cubic feet of gas per hour with little illumination

With the advent of the incandescent mantle burner, such as sold by the American Gas Light Co. of New York, gas lamps became quite popular and are used now to some extent. These lamps are economical, burning only three and one-half to four cubic feet per hour. The average price for such service is about thirty dollars per year.

They are, however, open to the objection that they must be individually lighted and extinguished. The rapid shrinking of the mantles with a diminuation of candle power is another bad feature.

[illegible] the lamp and [illegible] with improved and [illegible] the lamp and system while [illegible] to the open arc because of the [illegible] presence of [illegible] of great brilliancy the eye [illegible] beyond the glare to get the full value of the relatively feeble light at a distance from the lamp.

There are many other objections to the open arc, one of which is the heavy shadow it casts due to the fact that the lamp burns with a very short arc, the upper carbon in the form of a crater and the lower carbon to a point which intercepts the light emitted by the crater of the upper carbon. The heavy side rods necessary cause excessive shadows in two directions. The arc travels around the carbon quite rapidly and, being open, is affected seriously by wind and weather, causing a very unsteady and flickering arc and an uneven and poor diffusion of light.

These lamps have to be visited each day for trimming, which is a large expense that is indirectly borne by the municipality.

To meet the demand for cheaper light the "Half Arc" of twelve hundred nominal candle power was introduced. This, however, had the same objectionable features as the full arc, except the glare in the vicinity of the pole was less aggravating.

The inclosed arc lamp is by far superior to the open arc. In it we have a long arc burning in an enclosed globe in which the air is practically free from oxygen. Although most of the light comes from the crater, still a greater percentage is emitted directly by the arc itself owing to its length.

A large portion of the crater's area is visible over a wider vertical angle and the crater is not so concave as in the open arc; hence less concentration and better distribution of light. The principal variation in the light of an inclosed lamp is caused by the travel of the arc over the flat carbon ends.

This variation can be greatly reduced by the use of an opal enclosing globe which becomes luminous all over and obliterates the shadows which would otherwise be cast by the side rods and lower carbons. Even if we used a clear enclosing globe, the shadows are not so strong in contrast as those of the open arc.

There are two classes of enclosed arc lamps, the direct current and the alternating current. When consuming approximately the same watts at the arc the direct current lamp gives slightly more light than the alternating current both at the lamp and at the light-intersecting point. The difference, however, is slight and is made up by the better distribution of light to be obtained from the alternating current lamps.

It seems to me that the arguments to be found against the open arc lamp are so strong that it is practically eliminated from consideration by any municipality.

While the direct current enclosed arc lamp emits as much light when consuming the same energy as an alternating current lamp, it requires special generating apparatus which is more expensive than the static apparatus necessary for alternating current lamps and there seems to be little excuse for the installation of such a system at the present day.

Alternating current arc lamps may be had that consume any amount of energy from two hundred eighty-five watts to four hundred and eighty-five watts. The lamp chosen will determine the number necessary in a given distance to light properly.

The number of lamps per mile is governed to a great extent by established location, distance between cross streets, length of blocks and other local conditions. Nevertheless, the greater economy and superior illuminating value of small units is well worthy of consideration.

While with a constant arc voltage, the candle power of an arc lamp increases in proportion somewhat more rapidly than the watts, the lighting distance increases only as the square root of the candle power. It is therefore more economical to work with the lower efficiency arc at a short distance than with the higher efficiency arc at a long distance.

There are four standard units of the alternating current enclosed lamp, viz.: 485 (7.5 amperes), 425 (6.6 amperes), 350 (5.4 amperes) and 285 (4.4 amperes) watts per lamp. The distance to which these units will project a given illumination is 247, 227, 197 and 178 feet, respectively, with a corresponding watt consumption per mile of 5180, 4940, 4690 and 4235, thus showing in favor of the 4.4 ampere lamp a saving of 945 watts per mile over the 7.5 ampere lamp for the same illumination midway between lamps and with the additional advantage of confining their more brightly illuminated areas along the street.

By maintaining 5180 watts we can run slightly over eighteen 285 watt lamps per mile, but while the small unit will light a greater distance per watt, the advantage is somewhat offset by the increased initial cost and maintenance per mile for the additional small units required.

There has been developed in the last year a lamp that is a wonderful improvement over all type of lamps; it is the luminous arc lamp made by the General Electric Co. It is a direct current lamp of four amperes operated by either the Brush machine or Rectifier Tubes. This lamp operates with about three hundred to three hundred and twenty watts at the terminals and gives an effective illumination of about 30 per cent. greater than the enclosed arc, either series, direct or series alternating. Tests have shown that the direct current arc with 480 watts at the terminals gives a certain illumination at 257 feet, the series alternating enclosed arc with the same energy gives the same illumination at 247 feet while the luminous arc gives the same intensity at a distance of 325 feet. It is absolutely steady and casts no shadow. It has a life of 180 hours as against 80 hours for the other lamps and requires only one electrode at each trimming.

Many cities who are installing new systems have chosen the luminous arc lamps and the writer is installing them in Watertown, N. Y. The choice of globes for the enclosed arc lamps is a matter of some importance. Tests show that the opal enclosing and clear outer globe is a combination that gives the best results; the explanation being that the strongest light thrown from the arc at an angle of 35 to 40 degrees below the horizontal while it brilliantly illuminates the lower portion of the globe which diffuses the light upwardly and compensates for the loss by absorption through the useful angles.

A 6.6 ampere series alternating lamp has under test projected light through various combinations of globes as follows:

Opal enclosing and clear outer................	227 feet.
Clear enclosing V and clear outer............	207.9 feet.
Clear enclosing and Opal outer...............	192.4 feet.
Opal enclosing and Opal outer.................	188.5 feet

To advise in the abstract concerning the hanging of arc lamps is almost impossible as local condition practically force the use of one or the other of the various ways. Mast arms and cross suspension are generally used where the wires are overhead.

Pole top fixtures are used occasionally in public squares but are not very desirable where any other form of support can be used.

Where the system is underground, ornamental poles are desirable. The distance above the ground arc lamps should be hung must be determined for each individual lamp. For open arcs the distance should be about thirty feet, for series direct current enclosed lamps twenty-two feet, for series alternating enclosed lamps eighteen to twenty feet, for the luminous arc about thirty feet. However, in heavily shaded streets it has been found desirable to hang lamps as low as twelve feet from the ground.

Contracts for arc lighting should never be drawn on the basis of a nominal candle power. They should clearly specify the kind of arc to be installed, the amount of energy to be taken in each arc and the kind of shades to be used. The nature of the fixture should be specifically designated whether pole top, brackets, mast-arms or cross suspension as well as the height above the street each lamp should be hung. These and the location of the lamps should be designated by some one familiar with the practical street lighting with due consideration for each peculiar local condition. The hours of lighting should be distinctly stated with rebates for failure to provide continuous light within these hours. Such rebates should be merely nominal for deficiencies up to one or two per cent. of the total hours of lighting and punitive on an increasing scale for greater deficiencies. With all these things definitely stated in the contract and carried out by the contractor there only remains to deliver to each lamp the requisite quantity of current to insure good street lighting.

THE PRESIDENT: We have passed two or three papers of the last day or two on account of the changes regarding the use of the stereoptican, and I will call for those papers now, and hear such as are present; I believe the first is the report of the Committee on Taxation and Assessment, by Mr. Wm. S. Crandall.

MR. CRANDALL: Mr. Chairman, the report of the Committee will be exceedingly brief on account of the papers that have been read by title the other evening, and I wish to read the second paper by title also.

CONSTITUTIONAL RESTRAINTS UPON THE TAXING POWER.

BY LAWSON PURDY OF NEW YORK CITY.

Two-thirds of our states are tied fast by their constitutions to what is called the General Property Tax. They are bound to assess all property at its true value and tax it at the same rate and in the same manner regardless of its character.

These constitutional restraints were not adopted early in our history, but generally have their origin later than 1840. The revenue provisions of the constitutions of Illinois and Ohio are typical and have been extensively copied.

The provision of the Illinois Constitution was first adopted in 1878 and is as follows: "The general assembly shall provide such revenue as may be needful by levying a tax, by valuation, so that every person and corporation shall pay a tax in proportion to the value of his, her, or its property."

The Ohio Constitution adopted in 1851 is as follows: "Laws shall be passed taxing by a uniform rule all moneys, credits, investments in bonds, stocks, joint stock companies or otherwise; and also all real and personal property according to its true value in money."

The State of Minnesota adopted a constitution about 1858 and imitated Ohio; Idaho followed the Illinois precedent.

Progressive men in many of these constitution-ridden states are now actively engaged in an endeavor to release their states from the dead hand of the Fundamental Law.

THE GENERAL PROPERTY TAX.

Men with a practical knowledge of the workings of the general property tax condemn it unreservedly. The problem now is how to get rid of it. Many, however, who see that the general property tax is impracticable, unequal and unjust and oppose it on practical grounds, fail to condemn the theory on which it is based, and sometimes give assent to the justice of the theory. In this form the argument lacks the moral force to appeal to the mass of men who happily are more moved by moral than material issues.

The theory of the general property tax is far worse than the practice, for the practice is always tempered by the steadfast opposition of the inherent nature of men and things, and by mercy, ignorance and perjury. The theory seems to be that "Taxation should be equal and must be equally imposed on all property." This theory is not so old as the system it attempts to justify. Apparently it has been evolved from Adam Smith's statement that everyone should contribute to the state in proportion to the benefit he receives. Unfortunately he failed to lay down any just measure of benefits, and said that ability to pay taxes is the easiest ascertainable measure. Someone in this country conceived the idea that the aggragate value of a man's possessions measures his ability to pay, hence all property must be taxed equally.

A very brief examination of the attempt to tax all property equally will prove that it does not conform in the least to either of the canons of Adam Smith, namely, that taxes should be in proportion to benefits received or ability to pay. The equal taxation theory pre-supposes a community so isolated that population and capital shall be immovable, conditions which never did and never can exist. In fact men can move about and take their capital with them and can send it away to be used elsewhere for their benefit. Under these actual and natural conditions taxes on some kinds of property are paid by the owner, on others by the user, and in other cases the market value of the property is so decreased that the tax is no burden to the present owner. So long as the tax does not increase, the amount of the rate is immaterial to the purchaser of improved real estate, because the tax reduces the purchase price. The purchaser buys a net income of 5 per cent. or more, and, conditions remaining the same, gets what he paid for. Another man buys 5 per cent. bonds at par, the price being fixed by world markets. The tax is two per cent., and his net income only 3 per cent. The same principle applies to the tax on the stock of foreign corporations. Capital invested in manufacturing or stock-raising in competition with untaxed capital yields a poor return. The tax on machinery, goods and credits, or on live stock, cuts down the profits. Capital invested in retailing goods with which there is no outside competition, can make an average profit by adding the tax to the price of the goods.

The shifting and incidence of taxation are controlled by immutable natural law, which the equal taxation theory entirely ignores. The more perfectly the theory is applied the more unjust is the result. The Supreme Court of the United States has taken judicial notice of the injustice of taxing everything alike, saying: "This court has repeatedly laid down the doctrine that diversity of taxation, both with respect to the amount imposed and the various species of property selected either for bearing its burdens or for being exempt from them, is not inconsistent with a perfect uniformity and equality of taxation in the proper sense of those terms; and that a system which imposes the same tax upon every species of property, irrespective of its nature, condition, or class. will be destructive of the principle of uniformity and equality in taxation and of a just administration of property to its burdens." (Pacific Express Co. v. Seibert, 142 U. S. 451.)

THE TAXATION OF INTANGIBLE PROPERTY.

No one is willing to uphold a tax avowedly unjust or unequally imposed upon property of any particular class. Those only who have not given careful thought to the incidence of the tax approve a tax on intangible personal property. When a state attempts to tax intangible personal property one of two results is inevitable. If the tax is equally imposed, without any exemption, on all evidences of debt of a class over which the state can exercise jurisdiction as to the entire class, the rate of interest is increased by the amount of the tax and the burden of the tax falls upon the debtors, a result neither anticipated nor desired, and essentially unjust. The mortgage tax law of California and the tax on corporate bonds in Pennsylvania are illustrations. If the tax is imposed on evidences of debt or open accounts, the value of which is determined by conditions outside the state jurisdiction, or on which form the nature of the case the tax cannot be imposed with absolute certainty, the tax cannot be shifted by the lender, and conditions arise under which more than half the income may be confiscated—a result which must be revolting to any enlightened sense of justice. Illustrations of this second class of cases are so common in every state cursed by the general property tax that all are familiar with them.

THE FARMERS' INTEREST.

It is often assumed that the taxation of personal property under the general property tax is in the interest of the farmer. So far as intangible property is concerned the tax is theoretically indefensible. and the practical results show that the farmer has nothing to gain from such taxation. It is frequently stated that the farmer's property chiefly consists of land, and that improvements on land and movable property form a smaller proportion of his property than of the property situated in cities. The assertion is contrary to common observation of social growth, and to the facts disclosed by assessment rolls.

When a country is first settled land has no value. The property of the first settlers consists of such movable things as they bring with them. The next property to appear consists of improvements made upon the land, such as houses, barns, fences, and the improvement of the land for cultivation. Such communities still exist, and the value of their land is a small part of their aggregate property. As the density of population increases the value of land relatively increases, until we reach the condition of the City of New York, where in the sections in which land is most valuable improvements are not worth more than half as much as the land. There is one residence section of New York, less than three square miles in area, in which the land value alone exclusive of the buildings, exceeds in value the assessed value of all the real estate, buildings included, in the whole State of Kentucky. In two other sections in the business district, which does not include the financial center, the value of the land alone exceeds the entire real estate assessment of the State of Missouri. These two sections are less than six square miles in area. The assessed value of the land exclusive of improvements, is $919,000,000, and the real estate assessment is $1,291,000,000.

The value of movable personal property bears some relation to the value of buildings, and it is obvious that as land grows more valuable the movable property on it is worth less in proportion. These deductions are all emphasized by the assessment rolls of states which have the general property tax. In Ohio, Illinois, Kentucky and Missouri, personal property is a larger share of the property taxed in the country than in the cities. The Missouri assessment rolls for 1903, the latest I could obtain, confirm this statement. There are only four large cities in the state, and the effect of the personal property taxation is shown by a comparison between the city, counties and the remainder of the state, and between the City of St. Louis and one of the rural counties. In the four city counties personal property amounts to less than 20 per cent. of the total assessed value of real and personal property, while in the remainder of the state it amounts to 29 per cent. In St. Louis personal property amounts to 20 per cent. and in the rural county of Camden it amounts to 35 per cent. of the total. Camden County is an exceedingly good illustration of the way the taxation of personal property affects the farmers. The assessed value of the property in the county is $2,003,040. Of this amount 35 per cent is personal property, and two-thirds of this personal property by value consists of live stock; that is over one-fifth of the entire taxable value of Camden County is live stock. Under a severe listing system it is absolutely impossible for farmers to avoid paying taxes on their live stock, and the result is that farmers, as a class, pay vastly more in taxes than they ought to pay. The effect of this upon the cities is indirect, but none the less extremely harmful. The farming industry is discouraged, and country boys are driven to the cities, where their competition reduces the wages of those who are city born.

Such being the facts it should be easy to convince the rural population that they have everything to gain and nothing to lose by new methods of raising state revenue.

A PRACTICAL PROGRAM.

While the primary object must be to amend these constitutions, it may be desirable and even necessary to present a practical plan for action after constitutional restraints are removed.

Many years ago it was recognized by students that the revenue systems of the state and local governing bodies must in some way be divorced. The arguments for the change were so compelling that the attempt has been made in many states, and in a few has already succeeded. At the beginning of this movement there seemed to be only one way to accomplish the result, and that was by providing revenue for the state by special taxes on selected subjects of taxation and levying these taxes at unvarying rates. The serious objections to this plan were foreseen by few, but they are especially forced upon our attention by the experience of New York.

For over twenty years the State of New York has been attempting to separate the sources of state and local revenue, and up to twelve years ago had not progressed very far. In 1894 the state still relied mainly for its revenue upon the general property tax; that is, upon the tax laid upon real and personal property as assessed by local officials, the tax being levied by local officials and collected by them, and the proportion required by the state being turned over to the state by the county treasurers. In this manner the state raised about $9,000,000 in that year, and the revenue from special taxes levied for its own benefit only amounted to about $4,000,000, the total revenue of the state being approximately $13,000,000. This year the state's revenue will be about $27,000,000, all of it derived from special taxes, there being no tax for state purposes included in the general property tax.

In the struggle to obtain exclusive revenue for the state great changes have been made, many of them far from desirable. The taxes for state purposes upon various corporations have been increased since '94 from $2,000,000 to $7,000,000. A liquor license law has been enacted, which has increased the revenue from this source, and half of it has been given to the state; the state's half now amounts to over $9,000,000. By changes in the Inheritance Tax and through the increase in wealth and population, the receipts from this tax have been increased from $2,000,000 to nearly $5,000,000; last year it was over $5,000,000. In 1905 a tax was imposed on sales of stock which yielded over $6,000,000.

The activities of the state have been enlarged, and in twelve years its revenue has more than doubled. The inevitable tendency when taxes are laid at unvarying rates is to spend all the proceeds, and when more money is needed to seek out some new source of revenue. There is thus little check to extravagance, and subjects of taxation are selected and methods of taxation devised which are undesirable and hurtful to the prosperity of the state. In spite of all this, however, the end was a desirable one, and it is only the means which are open to criticism.

A FAIR METHOD OF RAISING STATE REVENUE.

Six years ago the New York Tax Reform Association devised a plan for raising state revenue which at the same time would obviate the necessity for levying a state tax on all property as assessed by local officials, or of imposing any more special taxes on selected subjects. By this plan so much revenue as the state should require in excess of the revenue produced by the special taxes in force would be apportioned to the several counties of the state in proportion to the revenue raised by each county and by all the taxing districts within it. Then the counties were to be left free to raise that amount of state revenue under the general laws of the state by taxing only such subjects as they should select. After a consideration of the matter for six months the Committee on Taxation of the New York Chamber of Commerce unanimously reported in favor of this plan, and the report was unanimously approved by the Chamber. In their report the committee pointed out that the tendency of the legislature to derive revenue from special taxes for state purposes, and to rely on this revenue exclusively, would take away from taxpayers that interest in state expenditure and state taxation which is present when taxation is direct; that it would tend to promote extravagance; that it would throw the burden of state expenditures upon the urban political divisions; that it would deprive the political divisions of the state of subjects of taxation. It was also shown at that time that the various business interests of the state would always be in danger of being singled out as subjects for special taxation for the increasing needs of the state.

The plan of apportionment endorsed by the Chamber of Commerce was not adopted, and all these prophecies have been fulfilled.

Professor Edwin R. A. Seligman of Columbia University, who is regarded as the leading authority on taxation in the United States and who for many years has advocated the divorce of state from local taxation and the raising of a large part of the revenue for state purposes by special taxes. wrote a review of recent tax legislation in New York for the Review of Reviews of July, 1905. After pointing out that a system of state revenue which depended exclusively on special taxes is inelastic and objectionable from other points of view, he said:

"This is an unfortunate state of affairs, and will, if persisted in, lead to ultimate disaster. Every modern system of taxation must possess the element of elasticity. There is one scheme that has been suggested by the New York Tax Reform Association in New York and Ohio, and which has been put in partial operation in the State of Oregon, which would bring about this result. This is a method of apportioning the state tax and granting local option in determining the subjects of local taxation. It rests upon the idea that the necessary revenues may be derived by making each locality contribute to the state revenues in proportion to its own expenditures. The scheme possesses four advantages: First it would provide elasticity, as did the old system; second, it would tend to keep down state expenditures, because each locality would be interested in the control of state finance, an interest which is now fast being lost; third, it would tend to keep down local expenditures; and fourth, it would enable each locality to raise its revenue in any way that seemed best to it, and would put a stop to the conflicts between country and city. If the rural districts desired to maintain the personal property tax, they could do so; if the larger cities desired to substitute something else, they would be equally free to follow their bent."

The Local Option or Home Rule bill proposed by the New York Tax Reform Association was carefully drafted to avoid conflicting laws. It provided simply that the appropriate authorities of any county might exempt from taxation any class of property. It did not permit the separate counties to make any new law for the taxation of any property; all they could do was to remove a class of property from the taxing power.

Anyone familiar with the actual practice of assessors in any state, could readily foresee what would happen if such power of exemption were granted to local homogeneous communities, for in every state to-day such local option is to a large extent exercised in fact, without the sanction of law. Instances of this will probably occur to everyone. I knew of a case in the State of New York where the assessors by a formal vote resolved not to assess any personal property at all. In some rural counties live stock is never assessed. I was told the other day that in Chicago there is practically no attempt to assess the shares of stock of foreign corporations in the hands of individual holders. The outrage of such an assessment is recognized and the law deliberately nullified. With legal option there would soon be legal exemption of classes of property which to-day are seldom assessed, and gradually all intangible property would be exempted and such other exemptions of movable property would be made as experience should demonstrate would be for the welfare of the community.

CONSTITUTIONAL AMENDMENT.

The constitutions of most of the eastern states, which were made early in the history of the country, are what constitutions ought to be—declarations of general principles with no specific provisions for carrying out those principles. The constitutions of New York and Connecticut are silent as to taxation. The constitutions of New Jersey and Pennsylvania impose but slight restraints. That of Pennsylvania provides for classification, and Pennsylvania alone of all the states has never had a general property tax. These states have been able to change, improve and adjust their tax systems to modern conditions, and in many respects are far in advance of states like Missouri and Ohio which are tied by constitutional restraints.

Fear is sometimes expressed that the abolition of restraint upon the legislature may result in bad legislation. There seems to be little ground for such a fear, for no worse system of taxation can be devised than that now in force where the constitution requires the equal taxation of all property. The constitution of the United States gives all the protection a constitution can well afford.

The amendment of a constitution is, however, a political and practical as well as a theoretical proposition. Such an amendment should be proposed in each state as the people with their present knowledge are likely to ratify. However that amendment may be framed. whether present restraints are stricken out or new powers are inserted, there are two essentials. First, that the state may be able to obtain its revenue without relying upon a tax levied on all property as assessed by local officials; second, that some measure of Home Rule shall be granted to the counties of the state.

THE EXPERIENCE OF EASTERN STATES.

Some of the eastern states are fortunate in having escaped from the constitution mania. New York, Connecticut, New Jersey and Pennsylvania in spite of many and gross defects in their taxing system, are every one of them vastly better off than states constitutionally restricted. In New York debts may be deducted from the aggregate value of personal property. This makes the personal property tax a far more elastic system than when debts can only be deducted from credits, or when they cannot be deducted at all. By a law enacted this year all new mortgages are exempt from taxation entirely after paying an initial tax of one-half of one per cent. at the time of record. Banks and trust companies are assessed at their book value so that the assessment is uniform. The tax is also uniform, being at the rate of one per cent. throughout the state.

In Connecticut debts secured by mortgage of real estate in Connecticut are exempt from taxation. Railroads and street railways are taxed one per cent. on their gross value. ascertained by a comparatively simple mathematical rule. New Jersey has much to learn, and is going through the throes of a tax agitation, but for many years debts secured by a mortgage of real or personal property have been exempt from taxation.

In Pennsylvania mortgages and all credits are taxable only at the rate of four mills, and the personal property employed in manufacturing is entirely exempt from taxation. Taxes are not imposed on merchandise of any kind directly, but instead there are mercantile license taxes graded in proportion to the sales, at moderate rates. Banks are uniformly assessed in a similar manner to those of New York, and the extraordinary growth and prosperity of Pennsylvania bears witness to the wisdom of the tax system which they have always enjoyed.

CONCLUSION.

By constitutional restraints we lose a great part of the superb advantages we possess in our Federal system. The bond of union between the states leaves them free to develop each in its own way. If this development should continue unrestrained by state constitutions every state could learn something from the experience of every other state. The state with a good tax system would be more prosperous than its neighbors and would draw from them both wealth and population. The backward states in time would almost be forced to adopt the better ways of the wise and prosperous. So by this healthy rivalry in well-doing progress will be steady and no bounds can be set to its advance.

THE PRESIDENT: If there is no objection the paper will be received and spread upon the record.

THE PRESIDENT: The next paper is "Street Railway Situation in the City of Detroit," by Mr. Robert K. Davis.

MR. DAVIS: As there are a number of other papers to be read, I do not know but what it would be a better plan to skip some. Detroit presents at this time a very unique situation as to matters of the street railway plans, and I therefore will read only the main points of the paper, and leave the remainder to be printed.

THE STREET RAILWAY SITUATION IN DETROIT, MICH.

BY ROBERT K. DAVIS, OF DETROIT.

The street railway situation in Detroit presents at this time an interesting subject for consideration. To begin at its beginning, the controversy between the municipality and the street railway company began in 1891 in connection with a strike on the part of the operatives of the railway system for higher wages. During that industrial dispute, considerable bitterness was engendered between the citizens and the owners of the street railway lines, which were then operated by animal power. The discussion waxed warm and continued after the settlement of the industrial dispute. Upon the one side, the late Governor Pingree of Michigan, then the Mayor of the city, made the contention that the franchises of the street railway company had already expired, his view being that the grant made in 1879 and extending the life of all street railway franchises in the city was defective. An issue was framed upon this point and carried through the state and federal courts, with the result that the court of last resort decided that the grant made in 1879 was not defective, as claimed, but continued during its full period until 1909. The difference between the street railway company and the city has been, since that time, made the subject matter of discussion—some of it intelligent and honest, and some of it selfish and political—between the people of the city and the company, with the result that as the years have elapsed, the city and the company are now facing the prospect of the expiration of certain franchises in 1909.

The contention of Mayor Pingree and his associates was that the street railway company was charging too great a rate of fare, and he and they set themselves out to procure for the people and the city a three-cent fare, which was afterwards modified to the proposition of eight tickets for a quarter.

Failing in securing access to the streets upon which the franchises had been extended for thirty years from 1879 and thereby making new conditions with the street railway company which would result in something permitting the adoption of the eight for a quarter rate, a number of moves were made with various sets of capitalists, having for their object the purchase of the street railway properties by new capital which would grant in one form or another, the much desired reduced rates of fare. These efforts all failed of their object, although, at various times, each of them seemed upon the eve of completion.

The City of Detroit is peculiarly laid out for the purpose of street railway transportation. Modeled originally upon the design of the City of Washington, the system of radial streets provided in the plan of the national capital by L'Enfant, the French engineer, was put into the plan of the city after the destructive fire of 1805, the result being that from the center of the city, main avenues radiate in all directions, thereby rendering ready and direct access to the various sections of the City.

Imposed upon this radial system is the ordinary rectangular system of streets and avenues which is familiar in the planning of most American cities.

These radial streets were all occupied by the original street railway company, and under the franchises existing at the time, of the beginning of the Pingree agitation, a single fare was charged upon the lines running upon these streets and having their termini in the center of the city, so that to cross the city from east to west or from west to east, required the use of two lines and the payment of two fares.

A modification of these franchise privileges was made voluntarily by the street railway company upon the introduction of the electric system of transportation to the extent that lines terminating in the center of the city were consolidated in their operation and made into fewer routes crossing the city from east to west, a single fare being required from one point to another point upon these routes. Certain transfer privileges were conceded voluntarily, but these concessions were not sufficient to satisfy the demands of the public at the time.

In 1895 Messrs. Everett and Moore, who have since become famous as large operators in street railway properties, appeared upon the scene in Detroit and procured a franchise from the city, covering some sixty miles of streets, and proceeded forthwith to construct a street railway system.

From the nature of the situation, the routes thus authorized could not be direct, but were obliged to follow the streets forming the rectangular blocks and squares rather than the radial streets, which furnished the most direct routes to the center of the city, these latter being already occupied by the first street railway system. However, a system was built which developed certain portions of the city not then enjoying street railway facilities, and was put into operation upon the basis of an eight for a quarter rate during the hours of the day time and up to eight o'clock at night, and six for a quarter rate from eight o'clock at night until five o'clock in the morning, and a single five cent cash fare. Opposed to these rates was a straight five cent cash fare upon the lines of the already existing companies, modified by an eight for a quarter workingmen's ticket, available during two hours of the day, one in the morning and one in the evening.

The new corporation continued to give service independently for about four years, after which time it was absorbed into the Detroit United Railway, a new corporation composed of the owners of both the old and the new systems, and the two came to be operated under a single management and with such economies as grew out of consolidation of the expense of superintendence and the production of power; but so far as the eight for a quarter system and the original lines were concerned, they continued to be operated as separate properties, with separate rates of fare.

Detroit has 187 miles of railroad within its present city limits. Of these, 60 miles are operated under the eight for a quarter system. and the remainder under the five cent fare basis

The public duties of the original roads included the payment of an annual tax of two per cent. upon their gross receipts, the ordinary taxes upon their real estate for city purposes and taxes which included the assessment of a large valuation representing franchises for state purposes. In addition, these railways are required to make the foundations and maintain the pavements between their tracks, but no portion of the payment outside of the rails. The eight for a quarter system is required to pay no tax upon its gross receipts, and in consideration of the undertaking of its projectors to furnish cheap railway fares to the City of Detroit, it was relieved of the duty of providing foundations and laying and maintaining pavements between its tracks. This contribution toward the operation of the cheap fare lines represented relief from the two per cent. franchise tax upon about $800,000 of earnings per year, and from paving obligations which the Commissioner of Public Works has lately estimated to average $61,000 per year.

As between the eight for a quarter system and the five cent system, no provision is made for transfers for the benefit of patrons who desire to move from a point upon one system to a point upon the other.

The present condition of the street railway question in Detroit is, therefore, briefly as follows:

That two distinct fare systems exist, and that there is no accommodation afforded between these two systems except to such passengers as pay a straight five cent fare, and this accommodation is not a matter of right to all patrons, but of concession by the owners of the properties.

That two distinct sets of provisions exist regarding the public duties of portions of the system with regard to taxes and the maintenance of ways.

That as to the eight for a quarter system, franchises in effect at the present time will continue to apply to the lines of this system until December 4, 1924.

That as to the five cent system, certain of the franchises, being down town portions, will begin to expire in 1909, but not with such completeness that it will be possible to use them as the basis of the new system, beginning in the center of the city and extending to its outside districts. For instance: Certain accommodation made to the eight for a quarter railways when they were being constructed, to avoid duplication of tracks in the down town district, resulted in the occupancy by them of certain stretches of tracks, the franchises for which would have expired in 1909 had there been no interference, but which are now held to be extended to the full life of the Detroit Railway, or eight for a quarter, system's ordinance.

Several mayors of the City of Detroit have applied their genius to the settlement of this question. There has been considerable bitterness engendered in the discussions. Meantime, the present owners of the property have gone ahead, have practically rebuilt the entire system, refurnished it with equipment and maintained an excellent service. Even the most violent opponent of the street railway management will do it the grace to concede that the service rendered to the people of the City of Detroit is adequate and excellent. We who live in that city like to flatter ourselves that in quality and condition of track, that in quality and capacity of cars, in frequence in service, and the speed with which cars are moved, the street railway system in our city is just a little better than that in any other city in the United States. The present managers of the property have not been ungenerous in putting back into it a large portion of its income for its development and maintenance. Within ten years the city has added upwards of 100,000 people to its population. Owing to the friction existing between the railway company and the city government there has been in that period but two miles of additional railway route added to the facilities which existed ten years ago.

With the departure of Mayor Pingree from the office of mayor, and his assumption of that of governor, he was succeeded by the Hon. William C. Maybury, who held office for a period of seven years, and whose policy, while not wavering in the expression of the city's opposition to the railway company's claims, was one that was calculated to bring about peace rather than engender bitterness between the railway company and its patrons.

Mr. Maybury was succeeded a year and a half ago by the present incumbent of the mayor's office in Detroit, the Hon. George P. Codd, who, immediately upon his assumption of office, proceeded to bring about, if possible, a permanent and lasting peace between the people of the city and the street railway company, serving them upon conditions which would be fair to the people of the City of Detroit and at the same time not unjust to the capital invested in the street railway system.

A series of conferences, covering nearly a year, has recently resulted in the proposal by the mayor to the people of a new franchise, the terms of which have been the subject matter of negotiation between himself and the representatives of the street railway company, and are said by both to represent a final solution of the street railway question in Detroit, when it is considered that a fair return is to be provided for the capital actually required to reproduce the system and to maintain the present scale of wages paid to operatives. This latter, by the way, is the highest rate of wages paid upon any surface line in the United States, being twenty-five cents per hour for both motormen and conductors who have been in the employ of the railway company for more than three years—this group of operatives representing fully 80 per cent of the employees of the system.

The terms of the new ordinance proposed by the Mayor of Detroit and accepted by the railway company, are that all of the franchises of the various lines, some of which expire in 1909, some other in 1912, some others in 1915, and some others between that date and 1924, shall all be extended to the date upon which the franchise rights of the Detroit railway, or eight for a quarter system, will expire under the terms of its ordinance, viz.: December 4, 1924, and that in consideration of the continued permission to do business, the railway company shall accept the following conditions of operation: That for five hours of each day, viz.: from five until eight o'clock in the morning, and from half past four until half past six in the afternoon an industrial ticket fare shall be placed in operation at the rate of ten tickets for 25 cents, or 2½ cents per industrial ticket. That during the remaining hours of the day, a six for a quarter ticket shall be accepted for fare. The single cash fare rate of 5 cents, which seems to be standard upon all the street railways of the country, remains. These fares are to apply to all the lines, and a system of universal transfers from line to line shall be put into operation and maintained. Upon the gross receipts of the entire system, the street railway company shall be required to pay a tax of two per cent per annum into the city treasury as a franchise tax. As to public duties with regard to streets, the railway company shall be required to make and maintain foundations and pavements lying between its tracks and to maintain all pavements for twelve inches outside its tracks.

Furthermore, as the franchises will expire at a uniform date, viz., December 4, 1924, and as upon that date no municipal ownership proposition which might be suggested could be enforced as against the entire street railway system of the city, if that were at any time thought desirable, provisions have been made for the purchase by the city, at the expiration of the period of the franchises now granted, of the entire new system, upon an arbitrated value to be determined by a commission, a portion of which shall be appointed by the street railway proprietors, a portion by the city, and another portion by the local Chancery Court. The arbitrated value shall be the purchase price of the property, and in arriving at it, no acount shall be taken of the value of franchises or of the good will of the business. The arbitrators will be required to determine, as between the city and the railway company, the value of the property then in existence and capable of being taken over by the city as a going concern. It might be added that the new franchise provided for the immediate construction of twenty-three miles of additional track within the City of Detroit, and for the construction from time to time hereafter, as the Common Council may direct, of additional routes, the rights to all of which, under the terms of the new ordinance, will expire at the same time as all of the rest of the property, thus enabling the city, at their expiration, to come into the possession of every yard of street railway track within the city, if such a process shall be deemed desirable.

Ample reservations of police power and of the right to regulate the operation of cars, to alter routes and to provide all manner of other reasonable regulation of the street railway system is reserved in the ordinance to the Common Council.

This whole proposition is now being discussed by the people of the City of Detroit. Practically every member of the city government, regardless of politics, pledged himself, when standing for office, that whatever settlement was made between the street railway company and the city, should not become effective until it had received the final approval of the people as expressed at an election. While such an expression is wholly extra legal and has no binding effect other than a moral one upon the Common Council, the pledges of both the mayor and the members of the council are sufficient to satisfy the people that if they vote against the proposition, it will not be passed, whereas if they vote for it, it will be passed by the members of the council, regardless of their individual views upon the subject.

So far the ordinance has been received with considerable favor. A campaign of education is going on on the subject between the respective candidates for mayor, the present mayor, the proponent of the ordinance, being its most notable defender, while his political opponent, representing opposition to any street railway settlement that may be made at this time, preferring to await the expiration of franchises now nearly expired, before undertaking negotiations upon the subject.

So far the ordinance has received the approval of the leading business men of the city, a distinguished body of citizens having associated themselves into a Citizens' Committee, which has already audited the books of the street railway company and determined for itself what the cost of carrying passengers in Detroit is and what it should be, and what capital investment would be necessary to reproduce the properties.

In this campaign of education, the street railway company itself has been a considerable factor. It has offered free access to its books of account to any reputable citizen who chooses to investigate its conditions for himself, and it has printed in the public press a series of statements, covering practically the entire range of its business within the limits of the City of Detroit. The figures presented in this series of statements have been verified by the auditor of the Citizens' Committee and found to be absolutely correct.

On the whole, the discussion of the subject among our people is good natured and along the lines of producing the very best results for the city, while, at the same time, respecting the right of the street railway company to earn a fair return for its stockholders and bondholders upon a reasonable investment in the properties.

The City of Detroit is an industrial city which has been growing by leaps and bounds within the last five years. An exceedingly large number of new factories has been added to its industrial capabilities within that time, and their location has been such as to demand the best possible urban street car service. Upwards of 106,000 workingmen are employed in factories in our city and its suburbs. Our working people are very largely home owners. The conditions under which they live are excellent. We have no tenements and no slums. As a rule, persons employed in our industrial establishments live at some distance from the industrial district, and those of us who have given thought and attention to the subject of the street railway transportation in its various aspects as bearing upon the prosperity of our industries, convenience and comfort of our industrial class and the general progress of the city, are inclined to look upon the street railway settlement now before our people as embodying a series of happy comprises, under which, if it be accepted, the street railways will continue to be an instrument of great usefulness in the development of our city, and their owners, we hope, will realize a fair return upon their investment for the risk which they have taken and for the public service which they have accomplished.

Detroit is absolutely fair to capital. It does not take the position of inducing a manufacturer to establish his business in Detroit and wishing him good luck upon his investment, and at the same time, seeking to bring ill-luck to that capital which is invested in public service enterprises. We have tried to be fair in our city to all interests,, and the best argument that we have been sucessful is to be found in our constant growth and our increasing prosperity.

THE PRESIDENT: The next thing in order will be the report of the Nominating Committee.

MR. RUST: Your committee recommends the following nominations for your consideration:

President—M. R. Sherrerd, Newark, N. J.
First Vice-President—James Owen, Montclair, N. J.
Second Vice-President—Julian Kendrick, Birmingham, Ala.
Third Vice-President—Fred Giddings, Atchison, Kas.
Secretary—Geo. W. Tillson, Brooklyn, N. Y.
Treasurer—Lesley V. Christy, Wilmington, Del.
Finance Committee—A. F. Eggers, Newark, N. J.; T. C. Hatton, Wilmington, Del.; R. H. McCormick, Detroit, Mich.

THE PRESIDENT: You have heard the report, what will you do with it. I believe it is in order to present any other names at this time, if any are desired, and I believe the votes must be by ballot.

MR. REIMER: Mr. Chairman, I move that the Secretary be instructed to cast the vote of this convention for the officers as made by the Nominating Committee.

THE PRESIDENT: You have heard the motion, that the Secretary be instructed to cast the vote of the convention for the nominees as read. Any remarks? If not, those in favor of the motion will say "Aye," and those opposed, "No." Carried.

THE SECRETARY: The vote has been cast.

THE PRESIDENT: The next is the report of the Committee on Place of Meeting.

MR. SHERRERD: Your committee having canvassed the several invitations extended to the Society to meet in—Saginaw, Mich.; Columbus, Ohio; Niagara Falls, N. Y.; Norfolk, Va.; Atlantic City, N. J., and Detroit, Mich., take pleasure in recommending the acceptance of the very cordial invitation of Detroit, Mich., and the selection of said city as the place in which to hold the convention for the year 1907.

THE PRESIDENT: You have heard the report, what shall we do with it?

It was moved and seconded that the report of the committee be adopted.

The President: Is there any remarks? If not, those in favor of the motion will say "Aye," and those opposed, "No."

Carried.

The President: We will now listen to the report of the Finance Committee.

REPORT OF FINANCE COMMITTEE.

Birmingham, Ala., October 11, 1906.

Your Finance Committee herewith reports that it has examined the accounts of the Secretary and Treasurer and find them correct.

The balance on hand on September 5, 1905, was $721.92, and the receipts for the year $1,110.65, making a total of $1,832.57. The total disbursements, $1,038.57, leaving a balance on hand of $794.00. All of which is respectfully submitted.

AUGUSTUS F. EGGERS,
FRED GIDDINGS,
Finance Committee.

The President: I will call for the report of the Committee on Review by Professor Folwell.

Mr. Folwell: I understand it is the duty of this committee to gather into as brief a space as possible what the country has been doing in the way of improvement societies, and that must necessarily be statistical matter, and I therefore ask that this report be spread upon the minutes. The report consists of two papers, one by myself on The Progress East of the Rockies, and by Mr. T. D. Allin, on The Conditions West of the Rockies. He is not present, but has sent an interesting paper on the conditions of the Pacific coast.

The President: If there is no objection, the reports will be spread upon the minutes.

REPORT OF THE COMMITTEE ON REVIEW.

BY A. PRESCOTT FOLWELL, CHAIRMAN.

Your Committee on Review have endeavored to collect data from every city in the United States relative to the work done during the year ending between January 1 and August 1, 1906, Mr. T. D. Allin taking the Pacific Coast, and the chairman the remainder of the country. The results obtained by the former are detailed in a separate accompanying report. The chairman sent requests to the 350 largest cities in his division for reports for the year 1905, and received 56 replies thereto. Annual reports were received from 47, (the city engineer of Springfield, Ohio, took the pains to make up a most neat and tasty typewritten report, as none were printed); and data from 46 of these are given in the accompanying table. In a considerable number of these reports all the desired data were not given and could not be calculated from any statements contained therein. One report from a city of about 25,000 population in northern New York furnished not a single item covered by this table, although it contained alleged reports from every department of the city government is a pamphlet of 132 pages; even when the city engineer's report was examined as a last resource—and the reports of the engineers were generally found to contain more meat than any others—it yielded ten pages of the names of streets on which sidewalk grades had been given, two pages of lists of other miscellaneous work which the engineer had done, and absolutely nothing else; except for the reports of the departments of Education and of Fire, this is the poorest municipal report we have ever received.

One fact brought forcibly to our attention was the delay in publishing the reports of most cities. Few municipal reports are published sooner than six months after the termination of the period to which they refer, and in some cases eighteen months have elapsed before they appeared. One city had had all the matter in the printer's hands for six months except the mayor's report, and that has not been written yet. The value of reports would be increased several hundred per cent if they could reach the citizens within ninety days of the end of the year which they cover.

Too many reports give no data except in terms of dollars and cents. That a given amount has been spent for paving has a certain interest, but this would be increased many fold if the amount and kind of paving obtained for it were stated also.

The most complete reports are almost invariably those of the water departments. (Where no reports concerning the water supply are given in the table the supply is by a private company.) It is probable that this is because of the persistent work done towards obtaining uniform reports in this department. We believe that this Society could do no work more valuable than effecting uniformity and completeness in municipal reports. One effect of this would be the keeping by departments of the records necessary for furnishing these data. Incredible as it may seem to some, there are lighting departments which have no records of the numbers of street lamps in their city; water departments which do not know the number of fire hydrants, miles of mains or even the number of service connections on their system; and numbers of sewer departments have no

NAME OF C
Chicago, Ill...
Baltimore, Md
Cleveland, Ohi
Detroit, Mich.
New Orleans, L
St. Paul, Minn.
Cambridge, Ma
Reading, Pa ..
Nashville. Ten
Troy, N. Y....
Somerville, Ma
Springfield, M
Wilmington. D
Pawtucket, R.
Birmingham, A
Altoona, Pa...
Augusta, Ga...
Springfield, Oh
South Bend. In
Haverhill, Mas
Newton, Mass .
Fitchburg Mas
Rockford, Ill...
Atlantic City.
Woonsocket, R.
Nashua, N. H..
North Adams,
Poughkeepsie.
Pittsfield, Mas
Marion. Ind....
Concord, N. H .
Medford, Mass.
Gloversville, N.
Montclair, N. J
Carbondale, Pa
Melrose. Mass..
Barre, Vt ......
Greensboro, N.
Mansfield, Ohic
Meadville, Pa..
Edwardsville,

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TILDEN FOUNDATIONS

records, even approximate, of the numbers of house connections, to say nothing of their locations.

Several cities publish no reports at all. Some feel too poor to do so; but this can hardly be said of all, notably of two of more than 100,000 population each. In fact, an official of one of these writes that for several years the publication of municipal reports of public works has been prevented "through the efforts of contractors and others in this field." Perhaps no stronger argument than this could be offered for the prompt publication of complete data concerning all municipal expenditures.

We hope the Committee on Municipal Data and Statistics will energetically push this matter of municipal reports next year, and the present members of this committee will do all in their power to assist them, as will also, we are confident, the members for the coming year.

REVIEW OF MUNICIPAL WORK ON THE PACIFIC COAST, JULY, 1905, TO JULY, 1906.

BY T. D. ALLIN, MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS.

In a review of the public improvements made by the various municipalities of the Pacific coast, the difficulty confronting the writer is lack of data.

Requests for data were sent to practically every municipality in California, Nevada, Oregon and Washington, and replies were received from only about 30 per cent. of the cities and towns addressed. About 80 per cent. of the southern california municipalities have replied. No replies have been received from the earthquake district of California, the officers there, no doubt, having an abundance of duties of greater importance.

No report has been received from cities in the State of Washington, where several cities have made extensive improvements.

Attached is a tabulation of improvements made by the cities indicated in said tabulation. In addition to the improvements tabulated, the following improvements have been made or are about to be undertaken. All improvements tabulated or mentioned herein apply to the year, July to July, 1905-6, unless otherwise stated.

MONROVIA, CAL.

Water Works—Public. Have estimates on improvements of water works in preparation. Improvements will cost from $85,000 to $100,000. Bonds will no doubt carry.

Lighting Plant—Private. Lights installed, incandescent, 160.

POMONA, CAL.

Water Works—Private. Tunnel developing plant, cost, $2,400.

Lighting Plant—Private. Lights installed, arc, 40; incandescent, 400.

SAN BERNARDINO, CAL.

Water Works—Public. One 16-inch driven well, 1,066 feet deep, seven miles pipe lines, 2-inch, 4-inch and 6-inch diameter. Meters, 25.

Lighting Plant—Private. Lights installed, arc, 21.

RIVERSIDE, CAL.

Water Works—Private.

Lighting Plant—Public. Total lights now installed, arc, 67; incandescent, 32,199.

Garbage Disposal. Deposit-burn and bury on outside grounds.

SAN PEDRO, CAL.

Water Works—Public. Began two and one-half years ago with addition still being made.

Pumping Plant. One million gallons, cost $35,000; two wells, cost $5,000; one covered reservoir, capacity 2,500,000 gallons, cost $10,000; pipe lines, thirteen miles, cost $60,000; meters 45, cost $675.

Lighting Plant—Private. Lights installed, arc, 83; improvements last year, cost $5,000.

Five and one-half miles sewer just begun. Ten car loads crude oil for street work ordered.

ANAHEIM, CAL.

Water Works—Public. One and one-half miles pipe line, cost $1,263; forty-two meters, cost $616.

Lighting Plant—Public. Lights installed, incandescent, 719.

OCEAN PARK, CAL.

Water Works—Private.

Lighting Plant—Private. Lights installed, arc, 5.

Garbage Disposal. Plans for incinerator accepted; construction not yet begun.

SANTA BARBARA, CAL.

Water Works. One public, two private; two public reservoirs, 150,000,000 gallons capacity each. Running tunnel, 20,000 feet through mountain to new source of public supply.

Lighting Plants. Two private.

FRESNO, CAL.

Water Works—Private.

Lighting Plant—Private.

Garbage Disposal. Garbage hauled to yard beyond city limits and burned in pit. New pit dug with teams when old one fills with ashes, etc.

City Hall. Under construction, cost $75,000.

Sewer System. Under construction at cost of $175,000, including sewer farm of 972 acres, costing $30,000.

Oiled Streets. Not successful for wearing surface, but is successful for laying dust.

MODESTO, CAL.

Water Works—Public.

Pumping Plant. One and a half million gallon capacity; wells, 4; tanks, 4, total capacity, 160,000 gallons; pipe lines, 13 miles. Cost $60,000.

Lighting Plant—Public. Auxiliary to water plant. Lights installed, incandescent, 356.

Garbage Disposal. The scavenger hauls the same to the city dumping ground on the outskirts of the city, where it is burned at frequent intervals.

STOCKTON, CAL.

Bond election proposed as follows: Street improvement and repairs, $250,000; city hall, $125,000; fire protection, $60,000; storm water sewers, $35,000; outfall sanitary sewer, $10,000; children's playground, $25,000; Stockton harbor improvements, $15,000; garbage destructor, $20,000; electric lighting plant, $160,000. Total, $700,000.

Ten miles street work proposed for the coming year.

CHICO, CAL.

Water Works—Private.

Lighting Plant—Private.

Street Improvement. Work about to begin on one mile cement gutter and one mile of cement sidewalks. Other street and sanitary improvements to be commenced soon.

OTHER TOWNS IN CALIFORNIA AND OREGON.

Several other towns report no new improvement during the year, only repairs having been made on improvements made, such as water, sewers and streets.

CORVALLIS, OREGON.

Water Works—Public. One reservoir, 300,000 gallons capacity, cost $3,000.

City has just completed gravity water system, with fourteen miles conduit and fourteen miles of distributing system. Source of supply located in the coast mountains. Pipe line capacity 1,000,000 gallons with 75-lb. pressure.

Lighting Plant—Private.

OREGON CITY, OREGON.

Water Works—Public. Pipe lines one and a half miles, cost $8,000.

Lighting Plant—Private. Lights installed, arc, 22.

Garbage Disposal. All garbage hauled to a vacant tract outside of city and burned.

PASADENA, CAL.

In addition to the improvements tabulated there is much of interest that can be stated concerning this rapidly growing little city.

The population is now 25,000, which has increased 3,500 during the past year, with an average increase per year of 3,000 during the past three years.

The city's area is 11.4 square miles, making the expense for street maintenance and lighting very heavy, compared with its population. The tax rate for general purposes is limited to $1.00 per $100 valuation and the bonded indebtedness other than for school purposes is only $322,000.

Contracts have been let for 2.34 miles of asphalt paving and work has been ordered on 3.38 miles more, which when completed will give the city a total of 11.6 miles of asphalt paving. This work is costing from 18½ to 19 cents per square foot for 4-inch cement concrete base, 1-inch binder and 2-inch surface.

The surface of all macadam constructed during the past year has been treated with crude oil. 1.35 miles additional of this class of work has been ordered. From 1¼ to 1½ gallons per square yard of crude oil heavy in asphaltum is applied to the surface and the work complete is costing 7¾ cents per square foot. This class of work has proven very successful in Riverside, Cal., and it is believed that it will prove satisfactory in Pasadena for residence streets.

Contracts have been let and work is being done on fifteen miles of street oiling, the crude oil being applied to the natural surface and ten miles additional of the same class of work has been ordered.

This class of work is done by bringing the natural soil to an even surface and then applying one gallon per yard of crude oil, heavy in asphaltum, then a coat of clean, sharp sand or rock screenings is applied, and then another application of crude oil of about half gallon per yard is made, regulating the quantity of oil applied by the needs to thoroughly wet the sand and yet not leave the surface sloppy. The street is then thoroughly rolled with a six-ton roller. This class of work costs from 1 to 1¼ cents per square foot, and is very satisfactory for outlying residence streets, where traffic is comparatively light.

This last class of work is very general in Southern California towns and cities, and is very satisfactory considering its cost. When condemned, it is generally by persons expecting as enduring work as can be done for many times its cost. The general difficulties encountered with this class of work, and the same also applies to a more limited degree to macadam with oiled surface, is that it does not receive proper maintenance.

After construction it is too often left to take care of itself and the dear public wonders why it does not last equally well with asphaltum or brick pavements.

Oil as applied to country roads is usually of a still cheaper application, only the main thoroughfares being treated in the more thorough way. Except on main thoroughfares the main object being to allay the dust without an attempt to create an asphaltum surface. Many hundreds of miles of country roads in California have been made a pleasure to drive over when were it not for the oil they would be almost beyond endurance on account of dust during our long dry summers.

Another class of oiled streets now being constructed and which promise to be very satisfactory, is constructed by plowing up the street to a depth of six or seven inches and then working the soil to the bottom of the plowing by means of a spiked roller. Oil is added from time to time and the roller run over the same surface hundreds of times, causing the oil to be forced down into the plowing and become incorporated with the earth from bottom to top, with both oil and earth thoroughly tamped by the constant rolling into one compact mass.

In all, approximately three gallons of oil per square yard are used with the cost of the work varying from two to three cents per square foot. About one-quarter mile of this class of work has recently been completed in Pasadena, a part of which work is exposed to heavy teaming, putting it to a very severe test. This street is being watched with much interest, as many believe that it cannot long withstand such heavy loads.

In all classes of street oiling the oil is, or should be applied hot 200° F. usually being the temperature. Upon a large percentage of country roads the oil is applied cold on account of the lack of facilities for heating. When hot, the oil penetrates much more quickly, therefore incorporates with the earth or sand more readily and meets with much less complaint from the traveling public for the first few days after it is applied.

In treating city streets one side of the street should be, and usually is, treated at a time, permitting traffic to keep off of the fresh oil until all wetness is absorbed by the natural soil, or the sand application, as the case may be.

For the average residence streets the writer believes the macadam base with oiled surface to be the most nearly ideal streets yet constructed in California. The macadam forms a hard, unyielding base, while the oil, or more truly speaking, the asphaltum, as the oil contains 85 per cent. D grade asphaltum, mixed with sand, forms the carpet or wearing surface, which surface should be as thin as possible to prevent sponginess and yet thick enough to fully protect the macadam. The sand in the asphaltum produces the wearing qualities and the asphaltum provides the cementing qualities which binds the sand together, forming an asphaltum paved street of cheap construction which is noiseless and also dustless with proper maintenance.

Such streets, however, require more attention than asphaltum paved streets and should not be left to take care of themselves.

Water Works—Private. Water is supplied to Pasadena by three private companies, covering separate territories. Water is plentiful for present needs and is excellent in quality. The rates are low and the entire domestic service is metered.

One company has just completed a seven million gallon cement-lined reservoir. New pipe lines and meters are being added to keep up with the growth of the city. More extensive improvements would be made were negotiations to sell to the city entirely abandoned.

In March, 1905, Pasadena voted $931,250 for the purpose of purchasing the three water plants and for extensions. Antagonistic city officials were elected a week later. Technical difficulties arose. Suits were brought but court decisions so far have been favorable to the transfer of the plants to the city. When the city will acquire the plants is problematic, as the companies are no longer under legal obligation to sell even should the present administration change its attitude, which is not likely, and endeavor to purchase.

The people are strongly in favor of acquiring the existing plants, but are resigned to the necessity of awaiting the advent of a new administration with the additional delays incident to new negotiations with the water companies.

Fire Protection. The city voted $75,000 in May last for fire protection, including the purchase of three lots and erecting thereon three fire houses, enlarging the present houses and for equipments.

Lighting Plant—Private. Some eight months ago a dispute arose between the officers of the private lighting plant and the city council, when the city officials claimed the company was not furnishing the quantity of electrical energy for which it was being charged. The dispute went so far that the city called a bond election to vote $125,000 to establish a municipal plant, which carried. Soon thereafter the lighting company claimed a defect in the proceedings and got an injunction to prevent the sale of the bonds. The matter is still in court. The city determined to have a plant of its own, raised the tax levy 18 cents per $100 ($30,000,000 assessed valuation) and is going ahead with the municipal plant in as far as the money so raised will go.

Garbage Disposal. The garbage is hauled by private parties onto vacant lands and burned, a method becoming entirely unsatisfactory. The city owns land for the purpose and an incinerator will no doubt be erected in the near future.

Public Schools. One hundred thousand dollars was voted in the early summer for more grounds and school buildings. Four new buildings are being constructed, ranging from four to twelve rooms each, in addition to the enlargement of other buildings.

LOS ANGELES, CAL.

Los Angeles is a city of remarkable growth, its population having been increased fully 35,000 during the past year, with a growth close to 100,000 during the past three years.

The water plant is owned by the city, but electric lights and gas are supplied by private companies.

The greatest municipal undertaking during the past year has been the decision to go to the Owens River, in Inyo County, California, for an additional water supply.

The conduit for conducting the water to the city will be approximately 250 miles in length and will cost approximately $27,000,000, which, together with impounding reservoirs at the headwaters of the Owens River and other expenses will bring the final cost to approximately $32,000,000.

Such a bold undertaking had never before been entered upon for a public water supply by a city of the size of Los Angeles, but the water was necessary and could not be had in adequate quantity at nearer points and at a less expense. The people quickly recognized the undertaking as a necessity and entered upon it with the same cool, deliberate enthusiasm that they would enter upon any other business undertaking which they believed would repay them many fold upon their investment.

In the first bond election for $1,500,000 for the purpose of acquiring water rights and beginning the work, the vote was 14 to 1 in favor of the bonds, which clearly showed the united determination of the people to provide an abundant water supply for the City of Los Angeles.

Both preliminary and location surveys are now being made for the conduit, which will probably be of reinforced concrete, about 12 feet wide at the bottom and 28 feet wide at the top, from 8 to 10 feet in depth and covered.

Twenty-five thousand miners' inches are available, which is equivalent to 325,000,000 gallons per day, and is eight and one-half times the quantity of water now being used by the city. The conduit will be a gravity line throughout, over valleys and desert and through mountains, with an opportunity to develop fully 80,000 horse power along its line.

During the year ending November 30, 1905, the city laid 41.23 miles of the pipe varying from 4 to 24 inches in diameter, made 6,608 service taps and added 5,347 meters. At that date there was a total of 46,160 service taps and 8,832 meters. At the present date some 13,000 meters are in service.

Without meters the city was using 300 gallons per capita, but when 8,832 meters had been installed its per capita was reduced to 190 gallons.

No doubt the most interesting and important water case ever tried in the arid West was the case carried on during the past year by the city against the San Fernando ranchers. The Los Angeles River, from which the city has taken its water from the city's very beginning, has its origin from the seepage through the valley gravels along the lower rim of the San Fernando Valley. Until a few years ago the valley was used almost exclusively for grain raising. But few wells were in the valley and the water from these few wells was used only for domestic purposes at the few ranch headquarters scattered over the valley.

A few years ago, on account of the growth of Los Angeles, the lands nearest the city became valuable for truck farming and for the raising of alfalfa, crops requiring a large quantity of water for irrigation.

The ranchers, believing that they were the owners of any water that they could obtain from wells on their own lands, sank wells and put in pumping plants. As the number of wells and the quantity of water taken therefrom increased the city's river supply began to decrease proportionately with the quantity of water taken from the wells.

It was soon realized by the city that, with a rapidly increasing population, its principal water supply, made use of for more than one hundred years, was rapidly decreasing, and unless its use in the San Fernando Valley could be controlled, the city river supply would soon be depleted.

A year ago there were practically 500 wells in the valley, with new wells and pumping plants rapidly increasing in number, from some of which, when in use, more than 100 miners' inches of water was being taken. From all indications, unless prevented, a few more years would see thousands of wells in the valley and the water plane lowered below the channel of the Los Angeles River.

The city brought suit to prevent the ranchers from taking water from the wells for irrigating purposes. The case was bitterly contested by both sides with the best attorneys and engineers on the Pacific coast taking part. The city won the case in the Superior Court, but the case is now in the higher court.

Storm Sewers. The city is just completing twelve miles of storm sewers, varying in size from nine inches to seven feet. The smaller sewers are of vitrified pipe, but the larger diameters are of either brick or cement concrete. Both brick and concrete sewers are lined on the flow quadrant with vitrified brick. A bond issue of one-half million dollars has been expended, and another expenditure of a larger amount is badly needed for like purposes.

Sanitary Sewers. The city is now constructiong an outfall sewer to the ocean, which is only about sixty per cent. completed. Much delay and annoyance is being caused by bad ground and rebellious contractors. The contractors have thrown up the job and the city is now advertising for bids to complete the work, which completion will require about one year.

The old outfall to the ocean is entirely inadequate for the city's needs, and until the new outfall is completed the city cannot push the the construction of city sewers, which are badly needed.

It is the writer's belief that no sewage should be wasted in the arid West, where water is so valuable. A safety valve to a steam boiler is necessary, but every pound of steam allowed to escape through the valve is a waste.

Just so with the Los Angeles outfall sewer to the ocean, it is a safety valve, but every gallon of sewage passing through it to the ocean is a waste of the city's most valuable asset. A part of the sewage is now used for irrigation, and as plants for sewage purification become more fully perfected, no doubt a very large part and perhaps all of the Los Angeles sewage will be used for irrigation on the arid lands between the city and the sea.

NAME	Street Grading Miles	Sidewalk—in Miles			Curb—in Miles				Gutter—in Miles			Paving—in Square Yards		Oiled Streets Miles	Sewer—in Miles		Sewer—Flush Tanks			REMARKS
		Cement	Stone	Wooden	Cement	Granite	Wooden	Cobblestone	Cement	Asphalt	Cobblestone	Asphalt	Macadam		Outfall	Laterals	Miller-Porter	Walker	Other Kinds	
Los Angeles...Cal	40.00	75.00	....	....	80.00	Including Granite			......	....	....	......	......	35.00	7.00	14.00	50	..	..	Gutters, 30 Miles Cement & Cobblestone Paving, 6 Miles Asphalt, Br'k, M'c'd'm
Pasadena...... "	22.00	30.00	....	....	38.00	.....	.....	......	38.00	....	....	32,000	23,500	20.00	....	2.80	20	..	..	....
South Pasadena "	7.30	8 00	....	....	8.00	......	.....	....	4 50	....	....	......	......	20.00	....	......	..	..	..	....
Alhambra...... "	6.00	12 50	....	....	12.50	......	......	......	12 50	....	....	......	......	....	..	......	..	..	.	....
Monrovia ..... "	27.00	12.50	....	....	43.00	1.00	......	.....	1.50	....	1.50	......	....	22 00	....	......	..	..	..	....
Pomona....... "	4 15	6 52	....	....	8.76	......	......	1.50	0.40	....	1.50	......	......	20.00	....	......	..	..	..	....
San Bernardino "	6 50	2 00	....	....	2.00	......	......	......	0.03	..	....	......	......	12.00	2.25	......	5	..	..	....
Redlands...... "	5.00	2.00	....	....	...	10.00	....	......	10.00	....	....	1,200	72,500	5.00	3 50	1.50	6	..	..	....
Riverside ..... "	14.00	2 00	....	....	2.00	......	......	......	2 00	..	....	1,550	1,250	25.00	....	2.17	..	..	13	....
Corona........ "	2.50	3 50	....	....	7.10	......	......		1.30	....	5.80	.. .	......	3.80	...	.....	..	..	..	....
Anaheim ...... "	5.00	2.00	....	....	2 25	......	...	......	......	....	....	......	......	1 00	....	......	..	..	..	....
San Pedro..... "	13 00	11 00	...	....	15.75	.....	......	......	0.25	...	....	1,500	.....	20 00	1.25	4.75	48	..	..	....
Ocean Park ... "	8.40	17 00	....	....	17.00	......	.....	.....	......	.. .	....	41,000	......	7.20	8 00	6.50	..	..	..	....
Santa Barbara . "	1.10	... ..	...	....	......	......	0.80	.....	0 20	2.00	....	1,550	......	3.00	....	3.00	3	..	..	1.50 Miles Sandstone Curbs
Fresno ... . "	2.30	6 60	....	....	......	......	4.50	......	......	....	....	....	......	8 00	...	1.10	..	..	..	....
Modesto. ..... "	1.00	0.60	. .	....	0 30	......	0.30	.....	0.09	..	....	......	......	0.08	....	14.00	..	..	..	....
Stockton... ... "	11.00	3 00	...	....	0.25	.....	22 00	.....	22.00	....	....	1,202	100,000	0.25	....	15.00	..	50	..	....
Chico......... "	0.50	0.25	....	....	0.25	......	.....	......	0 50	....	....	......	10,461	.....	3.00	10.00	..	30	..	....
Portland ......Ore.	7.70	....	4.10	5.20	4.10	......	4.80	......	......	...	1.00	40,598	.....	....	2.50	5.00	..	..	..	34,465 Sq. Yds. Gravel Pavement 20,867 Sq. Yds. Bitulithic Pavement
Oregon City.... "	0.08	0.16	....	....	0.16	......	....	......	0.16	....	....	.....	2,000	......	....	.....	..	..	..	25 Sq. Yds. Brick Pavement
Reno ....Nev.	3.00	4.09	....	...	0.25	0 45	....	......	0.06	....	....	27,432	16.427	.....	1.09	2.02	..	..	..	....
Victoria......B. C.	0.70	10.00	....	...	0.20	0 20	.....		......	....	....	......	33,000	......	3.00	2.00	10	..	..	7,150 Sq.Yds. Wooden Block Pavement

Garbage Disposal. The city erected during the past year a garbage destructor, which a few months after construction was partly destroyed by fire. It has been rebuilt and is again in use. The garbage is collected twice weekly in the residence district and daily in the business section, the property owners being required to furnish their own receptacles.

General Improvements. Large sums are being expended for bridge, park improvements, new fire buildings and equipments and for city schools; library quarters are inadequate and a new building will be built in the near future.

SAN FRANCISCO, CAL.

So much has been written concerning the San Francisco earthquake and fire that the subject will not be undertaken in this review further than to state that the writer's recent observations in that city confirm the preponderance of statements heretofore made, that good construction stands out in conspicuous evidence to prove that buildings can be and have been constructed to withstand, with little injury, earthquakes as severe and no doubt even more severe than the earthquake at San Francisco. On the other hand, it has been proven that it is extremely difficult, from a cost standpoint, to erect structures not subject to very serious injury when subjected to such a fierce and uncontrollable conflagration as the one through which San Francisco passed.

The heat was so intense that even the granite blocks with which many of the streets of the city are paved, spalled badly, while the asphaltum of the asphaltum paved streets was burned clean to the base, leaving only the black sand which was part of the asphalt mixture.

On many other streets, however, where the heat was not so intense, the asphalt streets suffered but little or no injury.

T. D. ALLIN.

PASADENA, CAL., September, 1906.

THE PRESIDENT: That closes the program up to date. It has been suggested that we hold but one session tomorrow morning, and continue in session until we close the program. We have a considerable number of papers, nearly all on paving, and it was suggested that one of these papers be given this evening, but as it is now half past ten, I will not call for it unless you will promise to stay. We will therefore be compelled to meet at the time set in the program, and the time set is ten o'clock,—say we make it 9:30.

THE SECRETARY: I would like to say if there is any of the delegates who have railroad certificates, and have not handed them in, I wish that they would do so now. I would also say if there are any members who have not paid their dues, the Secretary would much prefer to have them here.

THE PRESIDENT: If there are any people who have not registered, I would be very glad to have them register.

Mr. Folwell then read his report as delegate to the installation of President James of the University of Illinois.

Your committee appointed to attend as delegate the installation of E. J. James as President of the University of Illinois, beg to render the following report:

The exercises extended over an entire week, but your non-resident delegate, Mr. Folwell, was present only during Wednesday and Thursday. Mr. Tillson was unable to attend.

On Wednesday morning the delegates were formally received in the University armory, provided with badges and programs, and permitted to examine the buildings. In the afternoon following a review by the State Governor of the University Regiment, the delegates formed in procession and marched to the armory, where the inaugural exercises were held. There were in the list of delegates 247 from universities and colleges in all parts of the world; one each from the U. S. Army and the Illinois National Guard; 32 from learned societies (including our own); two from religious organizations; 40 from agricultural organizations; 29 city and county officers; 50 from the Illinois boards of education; 33 from miscellaneous clubs; what percentage of these were present it is impossible to say. Most of the university and college delegates were gorgeous in multicolored robes of silk and velvet, and formed a striking picture in the procession. At the inaugural addresses were made by the Presidents of the Universities of Michigan, Johns Hopkins, Kansas, Tulane, Chicago, of Illinois College, and others, followed by that of President James.

During the evening an official reception was given by the new president to the delegates, which was followed by students' torchlight parade —the most interesting thing which had so far happened. Thursday was taken up with visits to the buildings and meetings of engineers and other scientific delegates. The remaining two days, which we missed, were given up to educational conferences and a football game.

It was undoubtedly the most elaborate and spectacular college function which this country has yet seen.

A. PRESCOTT FOLWELL.

THE PRESIDENT: Is there any further business to come before this Society at this time.

MR. HATTON: I move that we adjourn.

The President: Those in favor of that motion will say, "Aye." and those opposed, "No."

Carried.

9:30 A. M. OCTOBER 12, 1906.

The President: The first matter on the program is the report of the Committee on Disposition of Garbage and Street Cleaning by Mr. T. C. Hatton. Also paper on Street Cleaning and the Disposition of Sweepings.

Mr. Hatton: Mr. President and gentlemen. Regarding the report of my committee, I beg to state that we have been unfortunate in not getting together the papers that were anticipated, and one of the most instructive papers to the members of the Society and the public at large at this time, was to be presented by Mr. Bayles, Consulting Engineer of New York City. This will undoubtedly be of value to the Society in general, but I have received a letter from him since I arrived here in which he says that owing to the sickness of his wife, and a change in his household affairs, he has been unable to be with us or complete his paper, but that he will have it done in a few days, and I suggest the paper be read by title, the title of which is the "A Proposed System of Final Waste Disposition for the City of New York," and it be printed in the proceedings. The City of New York has this matter up in a very extensive form; they have appointed commissioners to look after it, and I think Mr. Bayles is a member of the commission, if I am not mistaken.

In addition to that your chairman attempted to get papers from several of our members situated in the different parts of the country on this subject, but I regret to say, that while several of them promised, none of them came up to their promises, and right here I want to state that it should be the duty of every member of this Society when he promises a paper on any subject, to abide by that promise, if they have to stay up at nights and lose sleep; there are none of them too busy to do that, after they promise it.

When we come to our convention and the chairmen of the different committees expect to get these papers and they are not here, it is very embarrassing. The paper I presented to you has been compiled through more trouble than the contents of the paper would indicate. Early in the year I got out 215 circular letters, which I sent to the mayors and other city officials of as many cities of the United States, and I am glad to say that out of the 215 circular letters I received 210 answers, which I think is rather remarkable, those letters embraced these inquiries, as to street cleaning; what was the cost, and the cost per item, the best method and the cheaper method of cleaning by machine or hand, which was the most satisfactory by contract or by force account, and the method of the disposal of the street cleaning trash; also the method of gathering ashes, and the cost of final disposition of the ashes; also the method of gathering the garbage, its cost and disposal of same. I must say, however, gentlemen, the answers after they came in with a few exceptions were so irregular and mixed with so much matter that was not pertinent to the subject, that when we come to compile a table, the table was really of little value to the Association, so I. had to pick out the real pertinent parts of the answers, and condense them into a report so that a layman could understand it as well as a technical man. This paper is entitled "Street Cleaning, Collecting and Disposal of Ashes."

STREET CLEANING AND THE COLLECTION AND DISPOSITION OF SWEEPINGS AND ASHES.

BY T. CHALKLY HATTON, CHAIRMAN COMMITTEE ON STREET CLEANING AND GARBAGE DISPOSAL.

The cleaning of streets has become a problem which during the past few years has caused the municipal officers having the matter in charge many wakeful nights following days of numerous complaints from righteously indignant citizens, and if this paper in any way alleviates the suffering of either, the writer will feel that the time expended upon its preparation is not wasted.

In attempting to prepare a paper which may assist the officers aforesaid the writer has encountered the utmost difficulty in securing comparative costs of street cleaning, and if he had been less familiar with the quality of work done in the several cities from which information was obtained, the comparative costs, as obtained, would when placed side by side, been ridiculous, but his personal knowledge of the several cities led him to see that the cleaning of streets was performed on a basis of the officers' "points of view," which was largely governed by the point of view of the average citizen and what had been done by those who preceded him in performing this duty. For instance one city of 80,000 population expended in 1905 only $6,000.00 for cleaning its streets, or seven cents per capita. That would seem to the average reader that this city was being ably and economically managed, whereas the writer, during a recent visit, found the conditions of the streets to be filthy in the extreme, and this illustration will fit almost any other city in this country which shows a per capita cost for cleaning its streets of less than forty cents. One of the most important duties of a municipal government is to keep its streets clean. It should not be content to sweep them occasionally, say once or twice a week, where built up, but no organic matters subject to decomposition should be allowed to remain upon the surface of the streets beyond a few hours at most.

The householder is required by the Boards of Health to remove from his premises all organic matters subject to decomposition for which he has no longer any use. Should, his back or front yard become dirty from such organic matters he is fined and made to clean up. when at the same time the municipal government is permitting horse droppings and vegetable refuse to lie for days at a time within a few feet of his front windows and doors unless a windstorm has come along and removed it inside his premises, which is often the case.

Animal and vegetable wastes, when dried, as they are after lying upon the surface of the streets for a few hours, are harmful to the human system. They find lodgment in the membranes of the nose, mouth, ears and eyes and become an irritant which largely induces catarrhal trouble, which is so very much more prevalent in the cities of the United States than in the European cities, where the streets are kept so much cleaner. The citizen of the average place where the streets are not well cleaned gets more or less accustomed to seeing horse droppings lying undisturbed upon the streets, and thinks little of it, but after he has lived in a city where these droppings are not allowed to remain only long enough to get them, while fresh, into a receptacle, he changes his point of view very much and views such dirt with feelings of disgust, and he has become a better citizen for having that feeling.

Before Col. Waring undertook to clean the streets of New York in 1895, he stated that the streets were almost universally in a filthy state. In wet weather they were covered with slime, and in dry weather the air was filled with dust. Artificial sprinkling in summer converted the dust into mud, and the drying winds converted the mud to dust. This is a very fair description of the condition of the streets as they exist to-day in the majority of the cities of the United States, and yet large sums are annually expended by these cities for cleaning the streets just as New York expended large sums prior to 1895 for attempting to keep its streets clean. The trouble seems to lie not in the smallness of the appropriations, but in the lack of system adopted by the average city official in having the work performed and the failure to have the laws observed which are usually a part of every city's code.

For instance the writer has frequently observed the surface of main streets in cities littered with papers, fruit skins, ashes, sweepings from stores and dwellings, where he knew ordinances were in existence prohibiting the depositing of all these substances upon the streets. He has observed, as all of you no doubt have done, pedestrians throwing whole newspapers in the streets, banana skins and other like matters also being thus disposed of while a policeman was standing by but paid no attention to this infringement of the law. He has seen the janitors of stores and business houses in entire blocks cast the sweepings in the street gutters without being molested by the conservator of the law as he patrolled the sidewalk in front of these stores, and yet there was an ordinance prohibiting this.

The writer believes the streets should be cleaned thoroughly and be so maintained, but he also believes that it should be the duty of every citizen to do his share towards preventing the littering of the streets, and he also believes that every good citizen concedes this point. Then the first point to be solved by the city official having the cleaning of the streets in charge is to prevent their becoming dirty so far as he is able under the law. To do this he must call in the assistance of the police department and have the police instructed to have the ordinances fully carried out. This step if honestly and firmly performed will soon change the point of view of the whole city, as your point of view is changed in the European cities, if you attempt to throw a piece of paper upon the surface of the streets in sight of a policeman. This is not a hardship to the average citizen, and the writer has seen its wholesome effects in many instances. In fact the citizen soon prides himself in being a part of a community which carries out such a law, and becomes more careful of his person and premises. It is of twofold assistance to the young in that it practically educates them to a spirit of tidiness. Col. Waring organized the youngsters in the slums of New York into street cleaning leagues, and the writer has done the same, with the result that this class of ordinarily careless children became tidy and careful of their personal appearance, and these lessons go with them throughout their lives. It is a noted fact that wherever a municipality improves the appearance of its property, either by sewering, paving, parking or cleaning the owners abutting upon that property will follow suit. Clean streets lead to clean houses and tidy people, and thus the whole community is benefited by the municipality keeping its own territory clean.

There is no universal system of street cleaning in use in this country in spite of the fact that all the large cities of Western Europe have had a universal system in use for many years with great success. In this respect we have not been benefited by the experiments made by our neighbors across the deep although we do follow their lead in nearly all other municipal improvements. We look upon ourselves as the greatest people living because we have not studied closely the ways and means of our European friends in accomplishing results which we are still far from having accomplished, and the American municipal officer traveling abroad sees at once how far behind we are.

The official of one American city will declare with the greatest confidence that the methods of cleaning the streets as practiced in New York City or Washington cannot be successfully carried out in his city because the conditions are different, whereas as a matter of fact he cannot clearly demonstrate the difference in conditions. because there are none. He will positively assure you that hand cleaning as a constant operation is far more expensive than machine cleaning, and when you request his proof he cannot produce it because he has kept no accurate record, but from an occasioned observation of the two methods he jumps at the conclusion that the machine is far cheaper.

For instance the writer received replies from the officers of 210 cities of the United States, to the question "which in your opinion is the cheaper method of cleaning streets, machine or hand?" and all the replies from those cities where no records were kept were to the effect that machine cleaning was far cheaper, whereas the replies from those cities where accurate records were kept proved without doubt that hand cleaning was much cheaper. These facts are here stated to show what a lack of information there is upon the subject, and until city officials study the question of street cleaning in a rational manner our streets will still be cleaned in the same old slip-shod extravagant manner as most of them now are.

It might be well at this point to outline briefly what the writer learned from the replies received to a circular letter, sent to the mayors of the cities of the United States, east of the Mississippi, having a population of over 20,000.

Of the 210 cities, 81 cleaned by hand alone by day labor employed under the direction of the street commissioner or a deputy. One hundred and fifteen cleaned by both hand and machines by day labor. Nine cleaned by machine and hand by contract. One cleaned by hand and machine by prisoners. One of over 45,000 population cleaned by private subscription only, and then at irregular intervals.

In 133 cities the sweepings were used for filling in low places on outlying streets and private grounds. In 49 cities the sweepings were used as a fertilizer. Of the 115 cities cleaned by both hand and machine by day labor 72 used the hand labor exclusively by day by which all paved streets in the business districts were cleaned once a day at least. The residence streets which were paved were cleaned from once a day to three times per week. The machines being used by night only. In 57 cities the two-wheel hand vehicle was used to retain the sweepings temporarily as they are swept up by hand. This vehicle having either a bag or metal barrel. The bag, when full, to be tied up and deposited upon the curb line to be removed by the horse wagon following the sweeper. In 37 cities the sweepings as they were gathered by the "white wings" were deposited in the nearest manure pit, and in 20, carts followed the "white wings" picking up the bags of sweepings left along the curb and leaving fresh bags for the sweepers. Of the 115 cities which cleaned by both hand and machine, by day labor, 96 sprinkled the streets ahead of the machines, the others apparently allowed the dust to fly. Eight cities cleaned their business sections after closing hours by flushing the streets from the fire hydrants and allowing all the dirt to wash into the sewers through the inlets.

There are several interesting points brought out in examining the results of these replies. One is that the majority of cities find that the street cleaning is best accomplished by day labor and not by contract. Another that machine sweeping is not popular if done during the day owing no doubt to the interference to travel and the dust which is thus bound to be raised. Again, that business streets are, in the main, cleaned once a day, residence streets, paved, were cleaned on an average of three times per week. Gutters in suburban districts cleaned upon complaints of the property owners. As stated there were 49 cities where the street sweepings were used as fertilizer, and from the writer's personal knowledge of these cities, they are surrounded by the most fertile lands with the most prosperous agricultural communities, from which the writer naturally concluded that these communities have been indirectly enriched by using good sense. And that it will be largely beneficial to any municipality to carefully gather up its street dirt, which is largely composed of manure, and deposit it upon piles or beds in different sections of the suburban districts, making a compost of it, and then permitting the farmers and truckers to remove this compost to the surrounding lands. The municipality will certainly be the winner in the long run by this system of disposal even though its first cost is greater than the present popular system of wasting this manure upon city dumps, and just think a moment of what this popular system is! One hundred and sixty-one cities in the United States east of the Mississippi River sweep up the manure which falls upon the streets, the vegetable refuse which is found more or less in all street sweepings, and the many other organic matters also found therein, and dump them in the partially opened streets, or upon low private grounds inside the city limits, where the organic matter, of which they are largely composed, is permitted to decompose so long as it is exposed to light and air, and the process of decomposition poisons the atmosphere of the entire neighborhood. Much of this organic matter is covered before it is entirely decomposed, a few years thereafter as the growth of the city requires, these low grounds which have thus been filled up with this manure, are improved by building thereon residences and when the occupants of these become ill they call it malaria, whereas they are being poisoned by living over a manure pile. Such a practice disgusts the senses of refinement of all when they are asked to look squarely into it, and yet it is the practice of 75 per cent. of the cities of this continent, cities which annually expend immense sums for sewers and pure water and for the observation of sanitary regulations. Seems ridiculous, does it not? But it is the result of following an old custom Let us get out of this old custom and solve this question in a rational manner. Let us spend a little more ready cash upon sweeping our streets in properly disposing of the sweepings by utilizing them for fertilizer as is done successfully by many European cities, and as we have so much opportunity for doing.

As has been asserted earlier in this paper the cost of sweeping the streets is known to but few of the officers of the cities who answered the writer's questions. In fact there were but 22 cities where the officers in charge could tell how much per mile it was costing to sweep the streets, and of these only 13 could tell the relative cost of cleaning by hand and machine, and yet there was expended for this purpose in 1905 millions of dollars, all for surface work of such a character that a good clerk working on an average of two hours per week for 52 weeks at a total cost of say $50 could have determined what the unit cost of street cleaning was in the average city.

As hereinbefore stated the answer to the question "How does the cost of machine cleaning compare with the cost of cleaning by hand," was "the machine cleaning is far cheaper," except from those 13 cities where accurate records were kept, and which showed beyond a doubt that the hand-cleaning was by far the cheaper process. The writer some weeks ago called upon the street commissioner of a city of 90,000 population and asked him the above question and the reply was as usual, machine cleaning about one-third the cost, but no accurate records had been kept. although both processes were in use. We went together upon the streets to view the work being done, and incidentally the cost, with the following result: One "white wing" had a district comprising the leading business street of the city, upon which two car lines were maintained. The street was paved with bricks, asphalt, bituminous macadam and granite block. The district cleaned by this one man was 2,700 feet long by 40 feet wide, and he got over it entirely once a day for every working day in the year, except when it rained or snowed. His wages were $9.00 per week. The sweepings were dumped by him in the nearest stable manure pit, which in some cases was two blocks away. We found by this method that this street was being cleaned for $1.25 per 10,000 square yards. Upon an adjoining residential street paved with bricks, the machine gang was then at work, and consisted of one two-horse sweeper, one two-horse sprinkler, six one-horse carts, one foreman and 11 men. Double teams 50 cents an hour, single teams 31¼ cents, foreman and six men 20 cents, 5 men 17¼ cents, the sweepings were being hauled 5,700 feet average haul, and dumped upon low ground. This gang cleaned at the rate of 3,305 square yards an hour, and at that rate the cost was $15 per 10,000 square yards or over ten times the cost by sweeping by hand. It is needless to add that the result of our investigation changed the opinion of that street commissioner, as it will do that of any other who will take the time and trouble of looking into it, remembering that the same condition of street must be maintained by either process.

The result of the writer's investigation has shown that the cost of sweeping streets by machine averages $7.53 per 10,000 square yards; by hand $2.45 per 10,000 square yards, and flushing streets about $3.18 per 10,000 square yards. That the cost per capita per annum for cleaning streets in the cities east of the Mississippi was in 1904 and 1905 53 cents and that the cost in those cities which kept its streets well cleaned was 75 cents per capita per annum. The last named sum being a very reasonable one when it is considered what it secures.

The writer is of the opinion that the best results, both as to quality and economy can be secured by cleaning paved streets by a well organized and efficient force of "white wings" by which the sweepings are collected and deposited in bags upon the curb lines to be picked up by carts which haul these sweepings to a compost dump located as near as possible to the district cleaned, when, after adding some hyperphosphate, the farmer is invited to come and haul it away. He believes that the cleaning should be done so frequently that no organic matter should be allowed to remain upon the surface of any streets for more than twelve hours and in the business streets where the travel is heavy, the cleaning should be done constantly by "white wings" having but 2,500 square yards of surface to cover per day per man.

After the business of the day is over a gang of men should flush the surface of every business street by means of hose attached to fire hydrants, and thus dislodge the fine dust left upon the surface by the hand broom. In the morning the street thus flushed presents a clean, pleasant appearance and it is free from those harmful dust compounds which induce catarrh, and other throat troubles. This process, properly administered. is within the means of any city large or small, the smaller the city the easier the process becomes. The cleanest kept city in the United States to-day is Washington and it has the largest street area per capita. The next cleanest kept city is Greater New York where the obstacles for maintaining clean streets are far greater than any other city of the United States. What can be secured in either of these two cities can be secured elsewhere if the powers that be "can simply get the proper 'point of view.' "

As an adjunct to the street cleaning process, all laws should be passed and observed, for preventing the unnecessary littering of the streets, and towards this end the city should erect and maintain proper receptacles upon the street corners for holding waste papers carried by pedestrians and for fruit peelings or other things thrown away by those who use the public streets, and no business house should be permitted to sweep the dirt from its building upon the streets. Instruct your police force that these laws must be rigidly enforced, then note how proud you will be at the end of a year that you are a part of such a cummunity.

The collection of ashes and solid household wastes is another duty devolving upon the community which has caused many anxious moments to the conscientious city officer. The queries which have presented themselves to his mind time and time again are as follows: Should the collection be a public or private duty? If public duty can it best be done by an annual contract for a lump sum, or by the load, or can more satisfaction be obtained by doing it by force account? How should this waste material be disposed of and where? What system is best to minimize the many objectionable things necessarily connected with collecting this material? and lastly, What should the collection and disposal of this material cost?

In considering this question the writer excludes the collection and disposal of garbage which he considers outside the limits of this paper.

Of the 210 cities heard from in 33 the collection of ashes and other household wastes was done by the individual property owners or occupants, in 74 the collections was a public duty but let out by contract at a lump sum, per annum. In 13 the work was done by contract at a certain fixed price per load of specific volume, and in 92 the collection was made by teams owned by the city, the labor being performed by force account. In some of the latter cities the wagons only were owned by the city, the horses and drivers being hired by the hour or day.

Thus it would seem that the large majority have reached the conclusion that the removal of waste household matters is a public duty. In those cities where it is left for individual effort many nuisances arise. For instance adjoining vacant lots become the depositing ground for ashes from sources unknown to the authorities. Alleys are frequently used as depositories, and unpaved streets get a lot of it when no one is looking, thus reducing the cost to the individual householder and increasing the nuisance to many.

The writer is firmly convinced that the best results can be obtained by the public assuming the duty of removing these waste materials.

Where the work is done by contract the general opinion is that it can thus be performed much cheaper, but the writer questions this considering of course that the same efficiency is maintained. In cities of 20,000 population or over, a regularly organized force of men and teams can be constantly employed during the winter months upon this work. so that no time need be lost if the city is properly divided into districts, and it becomes the duty of the force to cover each specific district in a certain unit of time fixed by ordinance. During the summer months the force can be reduced to such size as may be ample to cover the city which has been divided into larger districts. By this method as much work can be performed by the men and teams under competent supervision as could be performed by a contractor, and thus his profits could be saved. The city's force would have no incentive to miss house after house as the usual contractor's force does, and the work can thus be done much more satisfactory and certainly at the same cost if not less. If the work is to be done by contract or the writer believes it can be done more efficiently by paying a unit price per cubic yard removed, which would give the contractor an extra inducement to secure all the wastes he could, and thus the cause for the many complaints from the householders would be minimized.

With six exceptions all the cities heard from dispose of their ashes and solid household wastes by dumping them upon low ground or for filling in streets in suburban districts. In six cities these materials are sorted over by either independent persons or laborers employed by the cities, and all matters having any value are collected and sold, the residue either being taken to sea and dumped or used for filling in low ground.

The custom of dumping the ashes upon the low suburban streets of a city may be a necessary one, but it is certainly a nuisance to many residents who may be so unfortunate as to be compelled to live in the proximity of these ash dumps. Their houses are constantly filled with ash dust, and their nostrils with noxious odors, neither of which would be long suffered if these residents happened to be influential members of the community.

There are hosts of things in the average household wastes of a city, which are valuable. For instance the privilege of sorting the ashes and rubbish from the city of New York was in 1896 sold by the city for $140,000.00. Later the city retained the privilege and provided modern methods for separating the valuable matters from the rubbish, and realized a far greater profit from this source. Everyone interested in this subject has been impressed by seeing the number of persons around a city's ash dump engaged in picking out the valuable materials. Many of these persons live entirely by the money received from the sale of such materials as they thus pick up. Now why should the city not secure this value to itself, and thus materially reduce the cost for the removal of household wastes? The separation could be done much more economically and thoroughly if the city undertook it by first requiring the householder to separate all other matters from the ashes, and then providing proper depots for the reception and separation of these matters. The ashes should then be dumped at such places and in such manner as to protect every citizen from the nuisance whether he is rich or poor.

There are many systems in operation in the cities heard from for securing the ashes and household wastes from the householder. These embrace the putting of all such matters in a common receptacle; the separation of the ashes by putting it in one receptacle; the paper in another, and other wastes in a third. In some cities the kind and size of such receptacles is specified. The receptacles are in some cities placed upon the sidewalks near the curb line, in others near the stoop line, while in others the collector is required to go into the premises upon which the wastes are to be kept in easily accessible places.

Probably the best system of collection of ashes and rubbish is that which is in use by the city of Buffalo; it certainly minimizes the objectionable things connected with such collection to a greater degree than any other system of which the writer has any knowledge. The collection is done by contract. The collection being made once per week from November to May and twice per week the balance of the year. The more frequent collections in the summer months is due to the fact that the garbage is collected under this contract and by the same force. The householder is required to provide three separate receptacles, one for ashes, another for rubbish and a third for garbage. Any not so separated is not removed. There are three classes of wagons used, one for ashes, another for rubbish and the third for garbage. There are three separate gangs of men employed in each force. One goes ahead of the wagons, carries the receptacles from the premises, and sets them upon the sidewalk near the curb, the next gang dumps the materials into the wagons and the third gang follows immediately and returns the receptacles to their places upon the premises. The cost of this is 31 cents per cubic yard or $60,000 per annum, or 17 cents per capita. By this method the ashes are so entirely separated from all that is valuable that it can be disposed of without additional expense. The rubbish can be easily picked over and the valuable parts separated, whereas the garbage is hauled directly to the reduction plant. The householder is not required to get his clothes soiled, and his religion warped by rolling a barrel or box of ashes out of the yard, down the steps to the sidewalk, and carrying the empties back when he returns home at night. The appearance of the streets is not spoiled all day by unsightly barrels and boxes standing upon the sidewalks, where they are frequently upset by mischievious boys, and the atmosphere of the neighborhood is not polluted with decaying garbage.

The cost is but little more and the benefits are far greater than the usual method of requiring each householder to set his ashes and rubbish upon the sidewalk in the morning, where it frequently remains all day, and sometimes two days at a time. The writer believes that Buffalo performs this duty better than any other city from which he has secured information, and he knows from personal inquiries from its inhabitants that the system has proved very satisfactory.

The average cost of collecting ashes, solid household wastes and garbage is 26 cents per capita per annum, which includes the disposal of the ashes and wastes, but not the disposal of the garbage. The writer could not well determine the average cost of collecting the ashes and wastes alone, as in the majority of the cities heard from the three materials were collected by the same force, or under the same contract, but from such information as he was able to get the indications are that the average cost is 17 cents per capita per annum.

In closing this paper the writer desires to call out from its contents a few of what he considers its most important points:

A well governed city can only be so considered when its streets are maintained constantly in a cleanly condition, and that no matters subject to decomposition should be allowed to remain upon the surface of the streets for a greater period than twelve hours.

A well organized hand cleaning force of street cleaners is by far the most efficient and economical method of keeping the streets clean.

The street's sweepings should be utilized as fertilizer and never used for filling in low lands liable in the future to be used as building sites.

Flush the surface of the business streets every night with an abundant supply of water, so as to remove the harmful dust.

Keep an accurate account of the cost of cleaning the streets by any particular method in use, and so itemize such cost as to be of use to your colleague in a nighboring city.

Collect your ashes, household wastes and garbage so as to minimize the nuisance to residents and passers by, and require the separation of the three classes of materials.

Don't dispose of your ashes by dumping them in front of the little home of your suburban resident, and don't throw away the things of value contained in the ashes and house rubbish.

Provide receptacles upon the corners of the streets for retaining waste materials in the hands of pedestrians, and cultivate cleanliness and tidiness in the minds of your school children by an occasional talk to them by one of the leading city officers.

If this paper has given you any new or condensed information upon the subject of street cleaning and the disposition of ashes, or has started your thoughts to solving the problem of how to do the work better and cheaper than you are now doing it, the writer will feel repaid for the hours he has expended from a very busy life in securing from the officers of 210 cities such such information as is contained in the paper.

T. CHALKLY HATTON,
Chairman Committee on Street Cleaning and Garbage Disposal.

THE PRESIDENT: The paper is now open for discussion.

MR. FOLWELL: I would like to ask the gentleman in the figures he gave as to cost of cleaning the streets by flushing, if that includes the cost of the water used?

MR. HATTON: No, sir, it does not.

MR. FOLWELL: The cost of the water would have been quite an item in connection?

MR. HATTON: Yes, sir.

Mr. Folwell: It seems to me that this paper is the most valuable paper that we have read at this Association: at least it is interesting to me, and should be to everybody that is interested in sewers, paving or anything else; simply as a citizen he should be interested in the welfare of his own city, and it seems to me it should be of great value. There is one matter that might be brought out in some of these conventions, which has continually been forcing itself upon my mind for some time, and that is, so many of our cities are run on the basis of how much money they have spent, rather than the good they got out of the expenditures. It don't seem right to the people when asked to vote more money for cleaning the streets—because a great many of the cities do not clean their streets properly. The citizen would say the taxes would be so much a year, .and that same man has probably increased the cost of his household expenses 25 per cent., disregarding the actual raise in the material, his ideas grow as the country grows, he thinks his yard has to be kept in better shape, and keep his lawn, flower gardens, etc., in better shape, and he thinks this is money well spent, yet when the city tries to do the same thing in keeping its streets clean, he thinks it is an expensive administration; he should desire to keep the streets as clean as he does his own premises.

Mr. Howard: The duty of the engineers in this country is constantly educational. The legislative branches of our cities, and I am speaking now of my twenty-five years' experience in street work in different cities, seldom stay in office long enough to become skilled, and I am free to say that where politics is allowed to enter into this matter many of our cities will not sustain our engineers and men who strive night after night for most of the engineers do their real work at night. We have to be diplomatic, and the street cleaning is the most vital thing not only for the health of the community, but the maintaining of pavements, for which, including construction, we spent last year in the United States about $64,000,000, more than the cost of laying new railroads and maintaining them in the United States. The pressure of water forced down on a pavement is very injurious to it, because it destroys a pavement, not only by erosion above, but also penetrates through tiny openings and gets under a pavement, and lifts it as a whole or in part from the foundation. Take a paving brick 8x3x4 inches deep. It would have 24 square inches on the under side. A pressure of water sixty pounds per square inch penetrating below the brick would develop a theoretical lift of 24 times 60, or 1,440 pounds under that brick. If only one-fourth of the pressure was effective, there would be 360 pounds under a brick weighing only 9 pounds, the average weight of paving bricks. The only thing which retains the brick in place is cement grout around it. In practice, this grout is often imperfect and fills only a portion of the joints between bricks. Thus water applied under pressure from hydrants or flushing machines constantly lifts paving bricks from their bed, loosening and destroying such pavements, as well as other kinds. I was in Chicago fourteen days at the request of the Union League on the street cleaning problem, and I am not an expert, but I noticed that the water lifted the bricks very quickly; I have also seen them lifted in St. Louis by the pressure. Now as for granite blocks, I have seen it lift them; asphalt blocks weigh about 16 pounds set with bituminous cement, are not so quickly affected; water goes in a little hole, no matter how small, and the hydraulic lifts these things, and it is disastrous to these pavements.

MR. REIMER: I presume, as Mr. Hatton has had so many replies from various cities, there must have been many where macadam roads are in use. He referred chiefly in his paper to brick pavements, hard smooth pavements in reference to his cleaning, and why I speak of this is, in the little city over which I have charge of all the streets and waysides, we have nothing but macadam surface streets, and we sweep them by hand, and try to keep them clean, and are generally credited with having a clean city. I was very much surprised to get a report from one of our Massachusetts cities from a party who had been there; he was speaking to the street commissioner of that Massachusetts city, and was telling him how we swept our streets here, and he said: "You don't mean to say they sweep macadam streets?" "Yes," he said. "Not with brooms." "Yes, with brooms." And he seemed astonished to find out that we swept our macadam streets with anything. I do not know what the condition of his city could be, but at the same time Massachusetts cities have the credit of being in good shape.

MR. HATTON: In regard to sweeping macadam streets, I got a great many reports about macadam, and I did not include it in this because it would have been too long. The gentleman's experience with his friend reminds me of a few years ago when I was before the Civic League on this question; they had invited several city boards and councils to hear my address, and I was speaking about cleaning macadam pavements and how it was done, and I think four or five members of four or five different cities came up and said one after the other that it was absolutely impossible, they could not clean macadam pavements without injuring the pavement and went on record that such was a fact. Nevertheless they do clean them in almost every large city in the United States, and particularly in the surrounding cities of Montclair, and they don't injure the pavement; they can clean dirt or dirt streets without injuring them. I want to take this opportunity of expressing to the Birmingham citizens and its city engineer, the appreciation that we have all felt driving over these streets, as to their cleanly appearance. I have heard delegate after delegate make that remark, whether they cleaned these up for our special benefit, or whether they kept them clean; I cannot tell, but be that as it may, they are clean, and we should extend them the glad hand for doing so, if they only keep them up in this way.

MR. KENDRICK: I wish to say that I do not wish to take any credit for the street cleaning on myself. Mr. McCartin has entire charge of that matter, and I am sorry he is not here to explain his method of cleaning the streets. I will also say that the streets for the past few days have been in their normal condition. They are usually kept as clean as they are today, and no special efforts have been made for you gentlemen.

A MEMBER: I wonder if the gentleman, Mr. Hatton, will not change the word in regard to the boys, from malicious to mischievious?

MR. HATTON: Yes, sir, I will make the change.

THE PRESIDENT: We will have to pass the next subject, the report of the Committee on Street Pavements, Mr. Owen, chairman.

MR. OWEN: This seems to be quite a large issue at this time and evidently exciting a great deal of interest, because I have a great deal of material which might be submitted to this meeting, but whether you have time or whether you desire to hear the whole of it, is a question for you gentlemen to judge, but there are certain things I would like to present which are questions paramount and should be part of the report of the committee. The committee have outlined their program on the subject, stating first the report of the committee itself on the general trend and progress of the paving question of the country, consequently we will have a report from one member of the committee, of the condition of paving question in the western states, then we will have three or four individual papers on the different parts of roads and street improvements, and to bring the matter up, I would suggest that the report of the committee on the general condition of pavements be first given to you. Mr. Howard has been very kind to take the onus of a large portion of this on himself, and I will ask Mr. Howard if he is here, and ready to read the report.

REPORT OF COMMITTEE ON STREET PAVING.

Paving and maintaining the streets and roads of cities and densely populated counties is a difficult and expensive portion of public work. Ultimate economy means good first construction and prompt repairs, instead of neglect and relying only on what is termed the "life of a pavement."

The past tendency to depend for good pavements on bonds or guarantees is beginning to cease. The responsibility for good construction and maintenance is being gradually placed upon city engineers. Where a city depends upon a guarantee or bond, this means to transfer the responsibility from the engineer to the legal department of a city. Lawyers do not inspect a pavement and compel a contractor to keep it [illegible] good order. They [illegible] a pavement has become uneven as, for example, with poor brick and certain kinds of asphalt pavements [illegible] by weather and large traffic and then try to collect cash damages. The people would prefer to have a pavement in the street rather than a bond or cash damages. They therefore recommend that pavement guarantees be gradually abolished and that city engineers shall be made responsible to secure the best pavements of various kinds suited for the different streets and roads. Architects are held responsible for the construction of public buildings. They do not depend upon guarantees for proper construction. City engineers see to it that sewers and water works are constructed correctly. Such works do not depend upon bondsmen for lasting qualities. It is not the fault of the engineers, but generally of the legislative branches that guarantees and bonds have displaced true inspection. Under the present political conditions, however, no engineer who knows and shows himself competent in preparing specifications and looking after pavement construction and repairs, is interfered with by aldermen or members of boards of works.

In our cities during the past year the tendency has been to continue to get rid of old cobble and rough stone pavements, and to lay pavements with smooth or even surfaces. The use of durable foundations is steadily extending, for the general reason that the wearing surfaces of pavements, whether of blocks or various kinds, asphalt, bitulithic or other material, can thus be economically and better maintained in constant order.

In the suburbs of cities and in densely populated counties, earth, gravel and poorly constructed roads are steadily being replaced by properly constructed macadam and telford. In some places these are being treated with dust reducing compounds of various kinds. These compounds are often patented or proprietary and in experimental stages. Great progress, however, is being made not only in the materials used, but especially in the methods of application. The destruction of macadam surfaces by weather and traffic augmented largely by automobiles, makes the problem of durability and suppressing dust more important than ever. A special paper by the chairman of this committee will give additional information on this subject. The roads are being placed in the hands of experienced engineers to secure more economic and efficient construction and maintenance, not possible under old methods of superintendence.

The principal kinds of pavements which have been laid during the past year are as follows:

In large cities a decreasing amount of asphalt for new construction; a decreasing amount of granite block, but where laid the blocks are better laid than ever, and almost always on concrete foundations; an increase of the bitulithic pavement in many cities; an increase of treated wood block pavements on concrete foundation in a few cities; a small increase of brick pavement, much being with better bricks with joints filled with cement grout and laid on concrete foundations.

In medium sized cities very little granite and other stone block pavements have been laid, but more of it on concrete foundation than formerly; large amounts of the bitulithic pavement; a little treated wood block pavement on concrete foundation; a slightly increased amount of shale or better class of brick and a decreased amount of fire-clay or poor class of brick pavements; comparatively little asphalt pavement, except for re-surfacing old asphalt pavements; macadam with and without telford foundation to some extent in cities on outlying streets and avenues.

In small cities almost no asphalt pavement has been laid in the past year except in few cities for the first time; a very little treated wood-block on concrete foundation in a few cities; a slightly increased amount of miscellaneous brick pavements in cities of the middle west; an increasing amount of bitulithic pavement in cities previously using it, and in cities not having previously used it; macadam has been extensively laid as usual in small cities.

In suburbs and well populated counties the general trend is for an increasing demand for a perfect surface whether in broken stone or gravel road and also to the elimination of the dust problem due to the enormous increase of travel by automobiles. The dust problem can only be solved in an economical way by experiments and investigation of the use of extraneous material such as crude oil or tar.

Present pavement foundations are worth brief attention. Granite brick and wood-blocks are being placed upon cement-concrete foundations. Bitulithic and asphalt pavements continue to be laid upon suitable foundations, either of Portland cement-concrete or of coarse crushed stone thoroughly compressed and the upper surface filled and coated with bituminous cement. This latter is called a bituminous base and is successful on well drained and on unyielding sub-soils. Hydraulic cement concrete foundations have ceased to be roughened by the bad methods of chipping them with picks, or by partial incomplete tamping, so as to leave coarse stone projecting above the mass of concrete. One method cracks the concrete from the blows of the pick and removes some of the binding cement and mortar. The second method, tamping only sufficient to allow stones to project on the surface of the concrete, was extensively used and abandoned. Such imperfect concrete, however, is the basis of a patent or claims of a patent. This method leaves voids in the concrete by failing to tamp it until all the voids are filled. The resulting foundation is weak and not uniform.

The best practice, now extensively used in laying hydraulic concrete foundations for asphalt and bitulithic pavements, is to tamp the concrete until free mortar appears freely over the surface, then to immediately scatter or spread thereon a thin layer of clean broken stone of about two inches or a little less in size, and tamp the stone about half its depth into the soft surface of the concrete. These stones are thus imbedded in the base and projecting above effectually roughen the surface of the concrete and prevent the binder course of an asphalt pavement, the asphalt pavement itself, or the bitulithic pavement surface from slipping or forming rolls or waves. Your committee suggests that the specifications for concrete foundations of asphalt and bitulithic pavements would be improved by requiring tamping and roughening with clean broken stone as described above.

Telford foundation or some modification of it, or at least coarse crushed stone is being more and more used under macadam.

As to quantities of pavements in the United States, certain pavements have steadily increased and warrant a brief review.

Asphalt pavements of various kinds and qualities are still being laid, but with a very small rate of increase. It had its rapid increase during the eighties and nineties due to a demand for a comparatively quiet and sanitary pavement (that being then the only available one) and due to a practical monopoly combined with a system of agents or promoters. The asphalt industry is now somewhat broken up. There are several sources of supply and several companies and contractors laying these pavements. The result is cheaper and poorer work. Cities, with few exceptions, are not equipped to know, during the construction of asphalt pavements just what they are getting, good or bad. Excessive repairs and resurfacing of asphalt pavements, especially of those which decay, now falls on cities; guarantees or periods free repairs having elapsed. Many cities, therefore, hesitate to lay more asphalt pavements, at least until they can be sure from inspection of their own engineers or by special experts employed, whether or not they are getting good asphalt pavements.

Wood pavements some years ago were used in several cities and poorly laid. Such pavements were but temporary street coverings, and practically all disappeared. Many western cities, never having had experience of the great Nicholson wood-pavement fiasco, which put Washington City several million dollars in debt, to be paid long after the blocks had disappeared and which bankrupted Elizabeth, N. J., and embarrassed several others. Eastern cities seem to have forgotten the wood-block pavement craze of thirty years ago and are again having wood blocks offered to them. Many cities, however, have investigated wood pavements, with the result they demand concrete foundations and blocks treated by creosote or other equally good method to keep them from decay. Twenty cities have laid in the past seven years very small amounts of such wood pavements as experiments. About thirty other cities have laid during the past six years amounts varying from 1,000 square yards to about 350,000 in New York City. The increase of treated bood-block pavement, on concrete foundations is principally in large cities which can afford this pavement. It is used on streets of noisy traffic to suppress the noise. Because of the lack of experience of the true cost of maintaining wood pavements, cities eventually using them may have to pay much greater prices than at present. About 30,000 square yards of treated wood on concrete was in the United States in 1900. The average increase since then has been about 160,000 square yards annually. There are now about 1,000,000 square yards of these wood pavements in a little more than 50 cities of the United States, equal to about 57 miles of 30-foot roadway.

The bitulithic pavement is a modern pavement of a specific kind, laid under certain patented processes, methods and mixtures. Without describing this pavement more than to say that the wearing surface consists principally of crushed stone mixed in predetermined proportions and having a minimum amount of voids, and the whole mass cemented together with special bituminous cement which also fills the voids, it is sufficient to report that this kind of pavement began to be laid in 1901, in eight cities to an extent of about 20,000 square yards. Its increase since then has been an average of about 1,135,600 square yards annually. It is now laid and being laid in about 131 cities with an aggregate of about 5,698,000 square yards, or about 323 miles of roadway thirty feet wide. This pavement is worth attention because used by so many municipalities. It seems practically noiseless, little affected by weather and not as slippery as other kinds of monolithic pavements. There have been a few attempts to lay substitutes or imitations of bitulithic, but poor pavements or patent litigations have followed.

Brick pavements for many years were their own worst enemies, because of weak bricks and poor construction. During the past few years strong efforts have been made by some cities and by several makers to increase the requirements of the specifications and tests of paving bricks, so as to secure pavements better able to resist the action of weather and traffic. A reasonable degree of success is attained in some cities especially where complete specifications containing fully defined, technical tests, followed by a thorough inspection during construction, is the rule of procedure.

Macadam and telford pavements during the past year have been laid and repaired with more care than ever on certain streets and in the suburbs of cities. The demand and need for them is greater as the suburban population increases.

Respectfully submitted,
JAS. OWEN, Chairman,
J. W. HOWARD,
E. A. HARPER,
Committee on Street Paving.

MR. OWEN: Mr. Harper, of Kansas City, said he regretted it very much, but the pressure of his work kept him from being here with us, but he has sent a communication on the practice of the Kansas City country, which I think probably might be of interest.

PAVEMENTS OF KANSAS CITY, MO.

BY EDGAR A. HARPER, CITY ENGINEER.

All our paving in Kansas City is more or less in an experimental stage. We tried the cedar blocks and abandoned them some fifteen years ago. After that came a period in which all paving was asphalt. This asphalt was constructed through promotion by the Barber Asphalt Paving Company, they having agents on the street who worked on commission. The ordinance specifying their particular brand of asphalt, it being the policy of the city to depend upon the ten-year guarantee made by the paving company for the good quality of the asphalt surface rather than upon the inspection by the department. The first pavements laid by this company, during the period when they were building up their reputation, wore very satisfactorily, but of late years since they have gone into the trust, their work does not seem to be as well constructed. Within the last year and a half the Board of Public Works has adopted a method of "Open Specifications," in which they cut out the promotion through petition specifying a particular brand, throwing all the paving companies on an equality, and getting competitive bidding and considerably lower prices for work.

This necessitates an inspection and analysis of the material used by these various companies. We are trying to get the department organized to look after this branch of the work, but through the red tape and complications of a political department, we have not gotten this into satisfactory shape, and hope before another is out to have this department so organized so that we can give a satisfactory report on our asphalt pavements.

The only other pavement that we are trying is the bitulithic pavement, but we have no street laid with this pavement for more than six months, therefore, nothing that I could say would be of any value.

The Park Board has tried the creosoted wooden blocks on a portion of one of the boulevards. We have also laid it as a flooring on one of our bridges. This pavement has only been laid a few months and probably by the end of another year we will have some data on this class of pavement that will be of value. We are using the tamarack blocks with 16 pounds of creosote oil treatment. The boulevard was laid without tar filler, the joints being filled with sand. The first heavy rain after the pavement was laid caused these blocks to swell and in one or two places threw them out of the street grade. This was repaired and we have had no trouble with this pavement since. This was a 60 foot width of street, with an inch expansion on each side. This was probably enough expansion to take care of any variation due to heat but was not near enough to take care of expansion due to swelling of the blocks. The creosote blocks used on the flooring of the bridge were well covered with coal tar, filling the joints and a heavy coating of sand spread over the top while still hot. This was on a 4.7 per cent grade, but we have had no complaint from the teamsters using this viaduct. All we have heard from seem to be very much pleased with this style of pavement, even with a grade as steep as this.

We have a little Colorado sandstone and some vitrified brick. The vitrified brick used up to the present year has been very unsatisfactory. The various companies promoting their special brick, guaranteeing it for seven years. Within the last year and a half we have incorporated in our specifications the test adopted by the American Brick Makers' Association requiring that all brick used to be tested in a standard rattler. Our requirements allowing a 20 per cent loss during 1,800 revolutions. Since that time our bricks have improved in quality.

Mr. Owen: I have a paper here on "The Municipal Asphalt Plant at Hamilton, Ont.," by Mr. E. G. Barrow, City Engineer.

THE MUNICIPAL ASPHALT PLANT AT HAMILTON, ONT.

BY E. G. BARROW, CITY ENGINEER.

Gentlemen:

Our Society is eminently a practical one, and my connection with it as a member, extending now over ten years, has convinced me that papers describing some work accomplished are generally very acceptable, perhaps more so than those dealing with what should be done, useful as these latter may be. I trust, therefore, that the following account of our municipal asphalt plant may be interesting to the Society. The plant has, to my mind, demonstrated the necessity of every city owning its own plant. Repairs are made with less expense; no delay occurs as happens when dealing with a contractor, and an intimate and exact knowledge is obtained of the quality of the materials and the proportion and temperature at which they are mixed and prepared for use on the streets.

The two principal streets of our city were laid with Trinidad asphalt by the Kramer-Irwin Company some twelve years ago. The annual repairs, especially during the latter part of the ten years' guarantee period, became very numerous, and at the expiration of that time were done by contract at a cost of $1.35 per square yard. The Board of Works, owing to the excessive cost of the repairs, and also the tardiness of the contractor to do the work, decided to purchase the plant from the Kramer-Irwin Company, who did the original work at a cost of $8,500.

This plant consisted of four ordinary steel shell driers revolving on a shaft passing through them. The sand was delivered to drums by conveyors at the front, and after passing through them was discharged in a pit and elevated to a platform; the material from the four drums was then mixed and loaded into a bucket by hand and conveyed to the mixer by a trolley. There were two melting kettles of a capacity of about six tons each, a mixer, air compressor, engine and boiler, oil pump and two oil tanks of a capacity of about 4,000 gallons.

The street tools consisted of a five-ton steam road roller, fire wagon and surface roller, with tampers, rakes and other small tools.

On account of the unsatisfactory service afforded by the mixer, drums and drum shafts, the latter continually breaking the mixer leaking and the crude way of handling the dry sand, these four drums were discarded and a modern Hetherington & Berner single drum sand drier installed with a mixer, sand storage bin with a capacity of eight cubic yards, having attached at the bottom a measuring box, capacity eight cubic feet. The cost of adding new sand drier, sand bin, measuring box and mixer was about $3,000.

The sand drier is a single drum 42 inches in diameter, fourteen feet long, and is provided with exhaust fan for creating draught. The housing for drum is steel and the drum is carried via two bearings, a trunion on front end, and ring bearing on back and riding on rollers which revolve on eccentric pins to allow for taking up any wear. The heat passes around the outside of the drum to the front and then through the drum where it comes in contact with the sand passing through. The sand is conveyed to the drums by elevator buckets and after passing through drum is conveyed to storage bin by an upright continuous elevator. At the front end of the drier there is an opening to get samples of sand to test the temperature. Before passing into storage bin the sand passes through a revolving screen of No. 10 mesh when running surface mixture; in running binder a slide door is opened which allows the stone to go into the bin before it reaches the screen. The material passes from storage bin to measuring box and from there to the mixer, and then to the wagons, which can drive under the mixer platform. The material is not touched by hand from the time it goes into the drier until it reaches the street. We are having a closed kettle made of seven tons capacity with a mechanical agitator in it, and when installed will do the melting down in the open kettle and then transfer the material over to the closed kettle for agitation and delivery to the mixer by compressed air, thus doing away with one man now employed dipping out of the open kettle into the asphalt bucket which is on a trolley running over the kettle.

The plant, with its additions and improvements, consists of a Corliss engine of 45 horse power, with boiler of same capacity, sand drier, two open kettles of six tons capacity each. In addition we will have one closed kettle agitator of seven tons capacity, oil pump, two oil tanks of 4,000 gallons capacity, air compressor and barrel elevator for hoisting material. Capacity of plant about 1,000 square yards of two inch surface mixture per day. Number of men required to run plant, 15, including foremen and all men employed about the plant day and night.

On account of the original grading not being up to the standard the average thickness of asphalt laid in Hamilton this year is over two inches. Since May we have turned out of the plant 3,141 cubic yards of surface mixture and 502 cubic yards of binder. In resurfacing, the concrete has been treated to a coat of paint, consisting of California asphalt, fluxed to a proper consistency. This binds the surface mixture to the concrete and prevents the water from getting between the two materials; also prevents the surface mixture from creeping. On all new work we are using a course of binder next to concrete of about one inch thickness, and a course of surface mixture two inches thick, at a cost of 90 cents per square yard, mixing and laying. This includes taking up old asphalt and disposing of it.

The asphalt is California D grade with a mixture of Cuban, for we find that a mixture of hard asphalt, such as Cuban, adds toughness to the California.

In order to make the asphalt cement mixture, suitable for the different conditions of streets as to sunlight, traffic, etc., a Dow penetrating machine was used.

The sand is tested at the plant by a set of screens ranging from No. 10 to 200 mesh. In order to get a proper mixture and reduce the voids as far as possible and make a good compact mixture and on the grading shown in the sand as taken out of the measuring box over the mixer, depends on the amount of lime stone dust required to make the mixture of the proper grading to carry the required amount of asphalt cement for the service for which it is required. After the sand, stone dust and asphalt cement have been thoroughly mixed and dumped into the wagon, it is tested by what is called the stain test, in which a small amount of the mixture at the proper degree of heat is put between a folded paper and this placed between two boards, which are compressed to make an impression on the paper, and the density of this stain shows the amount of asphalt the minerals are carrying, which we find, should be as high as possible, in order to stand the great amount of moisture to which our pavements are subjected to by continual sprinkling.

MR. OWEN: Now I have also a paper here, which hardly comes under the first part of street pavements, but an interesting paper, and if we have time by and by it will be well to read it. It is "Earth Settlement in City Streets." I will lay it aside, and if you wish we can take it up later. The President has suggested to me, as I am somewhat identified with construction in New Jersey and living there, that I give a little experience of my own on that question, "Highway Construction."

HIGHWAY CONSTRUCTION.

BY JAMES OWEN, MONTCLAIR, N. J.

The subject of highway construction has been so extensively discussed among laymen and engineers that it would seem to be difficult to raise any question that would be novel or interesting in a gathering of this kind save for the fact that this Society is a gathering of laymen and experts, and probably the laymen would desire to gather data from the experts as his future guide in his official capacity, as to what pavement to use and what to reject, and on what basis his use or rejection should be made.

The assumption of the layman that road construction is a simple mechanical proposition, easy of achievement by an ordinary untrained intellect, while commonly accepted heretofore has been somewhat gainsaid in the last few years as the scattered attempts in this country of road improvement have been a success or a failure in the ratio that a competent engineer has or has not been in control.

The sentiment if the country at large is in favor of good roads. The engineering part in this work has hardly been in proportion to the growth of the movement and the result has been attempts on the part of one man or another to promote his own individual ideas of the work in total disregard of the peculiar requirements of his own locality.

The extent of this country is so great, the supply of road material so diverse, the climatic conditions so varying and the practice of road building so uncrystallized that it is impossible to give hard and fast rules for road construction for any given locality. One expert in roads will tell you that drainage is the *sine qua non* of road construction, but when it is conceded that one-third of this continent is arid or semi-arid, the problems of drainage ceases to be a factor. Another expert will declare that Telford and MacAdam laid down the principles of road construction which cannot be properly departed from, yet if no material of MacAdam's standard can be found within 500 miles, question of economy will put MacAdam into innocuous desuetude.

Another expert has found a natural material in his section that is so applicable to the requirements of his locality that in his broad-minded philanthrophy no other material is of any account or any use.

The fact of the matter is that road construction in the United States has to be developed on its own peculiar standard, which standard will vary in every locality according to topography, climate, geological formation, density of population and the particular requirements of that population. What is a good pavement in one section for climatic reasons may be a poor pavement in another, and what may be proper in one section may be too expensive in another under similar conditions.

The fundamental factors in road construction are as follows:

The earning power of the community.

The topography and climate of the section.

The available road material at hand.

The construction of the road itself.

As to the first, it can be easily seen that in a district with land worth $20 per acre, the paying capacity for road construction is much less than a country worth $100 per acre, the value of the land, of course, being based on its earning capacity, and yet it may be a correct assumption that $20 land might be worth $100 if it had good road communication. However, in the far future when all roads are improved this would cease to be a factor. At the present, however, the taxable value of land is potent in the cause of road construction, as it might easily be seen that a rocky farm, with no possible revenue, cannot be benefited by any road construction at any time. The general community must here enter and announce the plea that intercommunication by good roads is the first law of civilization. If the rocky farm cannot pay for its road the fertile farm beyond must have its means of communication willy nilly.

In considering the topography and climate as functions of road construction, the question of temperature first enters in as the line of frost, penetration in the ground is a vital point in construction. Methods used in road building in a warm temperature will not be found adequate for a cold climate, and coupled with this also enters the question of aridity. where there is no water there is no frost, so the warm area can really be extended so as to include the arid area. In the frost-ridden sections roads have to be constructed of greater depth and of harder material to ensure their stability. To offset this, however, in the extreme North the wear on the road itself is shortened by three or four months on account of snow. Outside of the arid section drainage is paramount. This must be artificial in the flat country and properly graded in the mountain districts. That is to say, water must not be allowed to stand on a flat grade or wash out the pavement on a steep grade.

As to material to be used for roads, the cost of transportation is the prime factor in selection of material and methods of construction. Road materials must be classed under two heads, natural material to be used as found, and artificial material, consisting of natural material broken up to be used. Given a natural substance of average use in an average locality it may be considered economically preferable to an imported material of higher character, but may not give such absolute good results. Good gravel in a well drained country without frost, properly laid and rolled, will give ideal results if properly cared for. If used in the frost limits its period of good use in the year may be extended by putting a layer of larger stone at the bottom.

In some localities there are soft limestones and gravel. The limestone makes a good foundation but does not wear well. Use the stone for the foundation and the gravel for a wearing surface and you will find good results. If no limestone exists then burnt clay can be made available for foundation. If there is no gravel it would then be better to import a hard, durable stone for the wearing medium on the limestone bed.

The slates, shales and the silicates are also available for good road construction. The shales are somewhat affected by frost and require renewals, so it does not pay to import them. The silicates, however, are of different character. Take noviculate, for instance. It is transported

200 to 300 miles with good economic results. Flint formations are also available, but they are rare.

Take the Mississippi Valley in general, however, and what shall be done with its roads? Good material for wearing surface is rare and unsatisfactory, and it is probably best to lay down to the people of these communities to face the music and build their roads in good shape, in approved methods of selected material, transported from a distance and pay their bills. Traveling through the State of Illinois, for instance, what should be done? No local material and poor drainage, but plenty of rich land and rich farmers, so let them pay the bills for first-class roads.

In Alabama. for instance, without better material, not first-class, but available, it would be better at first to make a moderate outlay and then when the farmer gets rich, let him have the best there is. If there is gravel available, let him use gravel for the present; if there is good shale, let it be used, so that the present difficulty of transportation in wet weather may be eliminated.

In all these improvements, however, a trained mind should be used. It need not be an engineer's mind, but it should be an experienced, intelligent intellect, so that any improvements shall have all the up-to-date requirements and no money be wasted.

A first-class pavement designed to use first-class material, prepared in a first-class manner, will be and always has been a failure if carelessly and improperly executed, and we have all seen such cases and know the result. In considering the construction of roads it will not be desirable to go into great detail or lay down any hard and fast rules, as I have found that excellent results can be arrived at in extreme variations of practice and the small final difficulties can only be determined by years of experience, and this final difference may be radically upset by special natural phenomenon for which no foresight can provide.

The following rules, if generally followed, always give good results: Grades must never be level. Minimum, ½ per cent.; maximum light load, 4 per cent.; maximum light load. 10 per cent.

Complete Drainage—Gravel Roads. Gravel with stones about the size of hickory nuts, with coarse sand and about 10 per cent. of loam.

Shale Roads—Gravel and Limestone. About four inches spread, letting travel wear it down. Limestone should be laid like a pavement and properly wedged and the gravel put on and properly rolled.

Telford and Macadam. Telford from eight to twelve inches, with foundation five to eight inches and broken stone three to four inches. Macadam from four to six inches in two layers, well rolled. Top stones well rolled with a final coat of screenings. Broken stone should be uniform in size from 1¾ inches to 1½ inches and properly screened, all dust taken out and put on top.

Character of Stone. 1, trap; 2, granite; 3, hard limestone; 4, soft limestone. In the hard traps packing must be used for proper consolidation. In the granite and limestones the binding can be done without packing. Good rolling is necessary for proper hard road construction. Steam rollers and horse rollers are equally efficacious if consistently used.

After a road is built, the question of repairs immediately enters in. A road just completed may require immediate care. Under any circumstances attention will be required within a year and so every system of road construction that is organized, should be immediately supplemented by a maintenance organization, for in time the construction department will disappear, but the maintenance department will be permanent. At the International Engineering Conference an English engineer told me he had 400 miles of road to be maintained, but he had only built a mile and a half that year. The maintenance department is the vital point in the future of the road development of the country. If roads are built and allowed to relapse, the money is wasted, and the country retrogrades. The stimulus of good roads is marvelous. The bicycle fever was its sequence, and the automobile is now with us. The automobile is growing purely under the encouragement of good road construction and is demanding attention from engineers as to whether there should not be new means and methods for road maintenance. and I will here recite certain investigations to that end.

While the users of the present improved highways, either in carriages, wagons or automobiles, have probably not noticed a more rapid deterioration of the roadways it has become apparent to those in charge of their construction and maintenance that more care and more money is required to keep the surface up to the proper standard; it is therefore obvious that with the probable enormous increase of travel, due to the perfection of surface, other means and methods should be sought that will be more efficacious and also as economical.

Another source of trouble arising from the extended use of the highways is the dust. This is of such extent that it is not only troublesome to the traveling public, but a positive injury to abutting property, whether residential or used for farming. In fact, fruit raising near a much used highway is almost a thing of the past. This dust nuisance has been the cause of recent investigations in Europe for means and methods for its abolition, and it will be in order to give a brief outline of experiments and results.

In congested communities, able to afford it, the past practice has been to use water, by periodically sprinkling it on the surface. This has suppressed the dust, but it has the effect of rapidly rotting the roadway unless extreme care is used in the application. Of later years other material has been used such as tar and crude oil, and in the consideration of these extraneous materials I will give a short outline of what has been done and attempted in Europe and this country.

France seems to have been the first country to consider the subject for in 1880 the engineers at Saint Fay la Grade used tar, but the undertaking was not a success.

In Oran, Africa, in 1898, M. Cardy had some roads oiled with aloe oil and massat oil and the results were so favorable that other towns in Algiers adopted the process. In 1898, however, extensive experiments were begun in California and 80 miles of roads were successfully sprinkled with oil.

In 1900 Engineer Rimini of France prepared a patent mixture of tar with a drier, the mixing being intended to hasten the drying process, but it did not give good results.

In 1901 experiments were made in France with tar and oil, and since then experiments have been conducted in various localities in that country with all kinds of material, especially tar.

The tar manifested such superiority over any other material that it was used exclusively in the further experiments for its practical application. The result of the investigation for proper application of tar in France may be summarized as follows:

The application must be undertaken only in dry weather. The roadway must be perfectly clean, dry and well kept. The tar will not stick if the roadway is damp but becomes loose after a short time.

In cold weather the tar becomes stiff too quickly and does not spread, besides it does not penetrate the surface of the road. If the latter is not entirely clean and free from dust the tar does not cling to it but becomes mixed with the dust when it is spread on the road.

In the application of the tar to the surface it was found that better results were achieved if the tar was heated to a sufficient temperature to enable it to flow freely, about 210 degrees F. Many devices have been originated for properly heating and distributing the hot tar. One, used at Neuilly, consists of a hearth with a tar reservoir over it, and a smokestack to increase the draught. Two kettles are used at one time, so that the tar can be warmed in one while the other is in use. The material is poured into pots with an open spout and poured on the surface. This plant is for a moderate application.

For large stretches a large plant was designated by M. Audoin, consisting of a sprinkling barrel which consists of a cylinder of about two liter capacity which rests upon a two-wheeled truck and filled by means of a pump. The tank is warmed by a portable hearth which is pulled from under the cylinder after the proper temperature has been attained. At the rear of the tank there is, as in sprinklers, a distributing pipe with a number of holes which spread the tar for a distance of five feet. The contents of the tank are sufficient for covering a length of 375 feet. If smaller tanks are used, or even simple sprinkling pots with open nozzles, the tar is spread over by means of broom to ensure even distribution.

In France it was found that before a tarred roadway is given over to traffic it is necessary to sprinkle the tar with a coating of sand. The sand further hardens the tar, protects it and prevents slipping of horses. It was found that the sand should be scattered after the tar has been allowed to harden for two or three days.

Attempts have been made, however. to coat a road with tar and sprinkle it with sand, and immediately turn the street over to traffic. Some of the sections do not seem to wear as well as the sections where the coating was given two or three days to harden. Others wore quite as well in spite of immediate subjection to traffic. To spread over the tar a rather course gravelly sand was used, occasionally fine sand, and here and there the street dust which had been swept together just before tarring. It is to be noted that gravel and gravelly sand gave bad results, for the larger pieces were forced into the tar coat under the action of traffic and made holes. By the use of street sweepings better results were obtained, although this is inferior to river sand. The street sweeping dust absorbs certain lighter parts of the coating. The best sprinkling material is fine sand, which was used on a section in the proportion of about 1cm. to 2,000 sq. meters of tarred road.

It is advisable to stop traffic entirely two or three days during the hardening of the tar. Where this is not feasible and would cause much inconvenience, first one half and then the other half of the street may be tarred. The period of hardening for the tar varies between two and five days according to the temperature, situation of the street (i. e. if exposed to wind or not, the composition of the tar materials, etc.).

By the addition of heavy oils the period of hardening may be lessened. The cost of the tar application in France was found to be as follows: August 1, 1902, a section of road about 370 feet long and 12 feet wide at Champetery was tarred. It had lately been repaired with slag and gravel and was in good condition. Travel was small. From August to November, 1902, the coating wore well, no dust or mud, and the street dried well after storms. From November, 1902, to April, 1903, several traces of wear were discernible, the stones showing through. During a rainy period the tar layer raised in places and formed with the tar remnants which came out at the denuded spots in a thick, sticky slime, which after drying served as a coating. From April to July, 1903, the tar disappeared in places chiefly in the middle of the road.

In July, 1903, the Avenue de la Tourelle in Sainte Mande was tarred. This avenue, which has a very heavy bicycle and automobile traffic, had a limestone surface laid in May, 1903. The tarring was done in July, same year, in damp, cool weather, and the results were excellent. The tar disappeared in places where the surface was not entirely dry when it was applied. This road was retarred in June, 1904, and there was still tar in places although not enough to prevent dust.

These and other experiments show that the tarring of the surface lasts about a year, and during that time there is no dust and little mud. It is, however, the unanimous view of the French experts that the wear of the roadway is increased through the tarring process. This can readily be appreciated since there is little dust and hence less abrasion of the stone. The tar surface is also waterproof and prevents deterioration from penetration of the water.

There is also a strong claim made as to the benefit of tar as a hygenic measure as it has a decided antiseptic action.

In England exclusive use is also made of tar for the maintenance of the surface of the roads and prevention of dust.

In this country the use of tar has become a recognized practice, although at present it is not extensive. One of the first applications was made in Jackson, Tenn., where a very successful experiment was made on practically the same lines as in France. The tar was heated to a temperature of 210 degrees, run over the road through a 1½-inch hose with a one-inch nozzle. The surface of the roadway was then broomed and covered with a light coating of clean sand and screenings and rolled with a steam roller. The cost of this coating was
and lasted about seven months. A section cut through the surface showed that the tar had penetrated one to two inches.

The town of Montclair, N. J., in the year of 1894, coated one of its streets on a steep grade with a mixture of tar and screenings and after a year of use showed little results of wear. At this time patches of the original surface are now visible showing the wear. This year the town has covered about a mile of roads and their surface is universally satisfactory, perfectly clean and smooth with no dust or mud.

The cost of the 3,400 feet treated this year was 30 cents per lineal foot, or 17 cents per square yard. This included 300 yards of cracked stone and screenings and if this item be eliminated from the outlay it will be found that the cost of tarring alone would be about 5.66 cents per square yard, comparing favorably with the French result.

The authorities of the village of South Orange, N. J., are also extensively repairing the streets with tar, with good results, and the Borough of Queens, New York, has also treated miles of its roads in the same way.

There seems to be one radical difference between the French practice and that adopted here. In France they merely sprinkle the surface of the spread tar with sand, especially rejecting gravel as they find the coarse material breaks up the surface of the hardened tar. In this country a coating of screenings is universally spread upon the tar with the design of incorporating as much as possible the tar with the dust.

Taking the practice in this country of using stone dust we find of course a large increase in cost by the extra price of the stone. On the other hand we have the saving of wear on the road itself by the fact that the tar and dust mixture acts as a cushion and lessens abrasion.

While undoubtedly the tar application for highway maintenance seems at present to give the best results, there are other materials now in use that are demanding favorable consideration. The most prominent is crude petroleum. While this medium is undoubtedly best for an arid region like California or Algeria, it has great disadvantages over tar in any territory where there is ample rainfall. It prevents dust efficaciously provided there are constant renewals, from three to four weeks being seemingly the limit of its usefulness. In wet weather it is objectionable, forming an emulsion with water which has a damaging effect on clothes and the paint of wagons and carriages. It also makes the surface mushy and is objectionable from that view.

A sprinkling material has, however, been invented for use on roads known as Westrumite. It is chiefly a mineral tar, which with the aid of ammonia or other cheap medium is dissolved in water. It is used in a two to ten per cent. solution and sprinkled from tanks in the ordinary way that water is sprinkled. The surface, however, has to be clean. It can be carried on in any weather, except very heavy rain, and requires no interruption of travel. The practice is to undertake the first two sprinklings with a ten per cent. solution and intervals of 24 hours. After that a five per cent. solution every two weeks. The cost for sprinkling with this material for three months, when sprinkling is required, would be about 3 cents per square yard, but this expense is merely for laying the dust and does not obviate the wear as in the case of tar.

There is also a material intended to lay the dust known as Coudrogenit, used in the same way as Westrumite, but its application is limited and correct results have not as yet been arrived at.

In this country a material has been put on the market known as Tarvia, which is being extensively used as the means of allaying dust, and so far its application fills the want for immediate delivery of a tar preparation for road surfacing.

Whether in the larger use of tar in the future its market price will be as economical as the use of ordinary coal tar is a fact that remains to be proved.

Tar as a medium for binding stone is no recent innovation. Years ago tar pavements were in great demand and use, and some of them are in existence to-day, but the knowledge of its use and properties is much more intimate than it was at that period.

Mr. Owens: One of the live subjects to-day is what is known as Bitulithic Pavement. The following paper gives a description of it:

BITUMINOUS PAVEMENTS CONTAINING CRUSHED STONE.

BY J. W. HOWARD, C. E., E. M., CONSULTING ENGINEER ON ROADS AND PAVEMENTS, NEW YORK.

INTRODUCTION.

The object of this paper is not to advocate any one kind of pavement—granite blocks, asphalt, bitulithic or other kind—nor to make comparisons between them. In my professional work in connection with pavements, whether testing their materials in my laboratories, preparing specifications, or inspecting pavements during or after construction, it is my duty to help secure the best materials desired or available in each locality and use them in the best ways.

During the past twenty-five years, among many kinds of pavements I have investigated in the United States and foreign cities, none has had such rapid rise as a relatively new type of pavement. The present use on the streets of about one hundred and fifty cities of monolithic pavements, containing crushed stone in the wearing surface, makes them worthy of careful investigation.

I will not dwell upon the many local conditions which affect all kinds of pavements, such as climate, wet, dry, hot, cold; traffic, heavy and light vehicles, quantity of vehicles and horses; width and grade of streets; cleanliness or lack of it; good methods of cleaning or those injurious to pavements, as flushing with water under pressure; and other conditions, not only for each city, but each street in a city. I will assume that these factors of the paving problem have received proper attention for each street.

I will omit reference to tarring, oiling, or other methods of dust reduction and semi-waterproofing of suburban macadam and other roads, as a branch of the subject requiring special treatment, after the present experimental stage has been passed. I will confine the attention to bituminous pavements for cities.

Sheet asphalt pavements do not contain artificial crushed stone. They are made either from natural bituminous limestone, ground and compressed as in Europe and a little in America, or are made from a mixture of sand, dust and asphalt-cement, as in American cities. Asphalt pavements are a group by themselves, some of them being valuable for city pavements, as I have endeavored to describe in previous addresses before our society.

The binder course contains crushed stone; but the binder is between the foundation and the wearing surface and does not come in contact with traffic. This binder under asphalt and in certain cases under bituminous pavements containing crushed stone, should be a close, dense and waterproof mixture, thoroughly compressed, as now prepared and used more and more, as cities learn the durability and ultimate economy of using close binder, instead of the open, loose binder which permits water to percolate through it, coming from joints at curbs, rails, manholes, etc. This water injures the foundation below and in many cases the wearing surface above the binder. This is taking place on hundreds of miles of streets, paved with asphalt, especially the kind easily injured by water. But binder, not being exposed to direct traffic and weather, does not need our further attention.

Asphalt blocks, as made in America, are practically crushed stone, sand and dust, cemented together with bituminous cements. They are relatively little used except in a few cities. Not being monolithic pavements, I will omit further mention of them.

FOUNDATIONS OF BITUMINOUS PAVEMENTS.

The various foundations for bituminous pavements need special constructions. The subsoil, as for all pavements. must be properly graded, compacted and securely retained at the sides by curbs or otherwise.

If a new foundation is to be laid, it can be either the bituminous base or hydraulic cement concrete base. Whichever used must fully sustain the very heavy steam roller needed to properly compress bituminous pavements of crushed stone. If these foundations sustain this test, there is no need of making them of undue thickness, and, therefore, excessive cost. If the subsoil is well drained and of a firm character, as when composed of stones, gravel or loam, mixed by nature or otherwise, then the bituminous base is of advantage to be used under bituminous pavements. The bituminous base is composed of suitable, coarse, crushed stone which should be compressed with a steam roller of at least ten tons. The surface of this base is coated with a suitable bituminous cement applied hot, letting a little surplus run down a short distance into the upper portion of the crushed stone. The bituminous base will adhere firmly to the wearing surface mixture when that is laid, and prevent displacement or rolling of the wearing surface into depressions and ridges. Bituminous foundations have been successful for various pavements in Europe and America for about thirty-three years and are being rapidly adopted everywhere. Another advantage of the bituminous base is the ease of access through it to pipes below the street, combined with rapid repair over such pipes.

If the subsoil of a street is yielding or poorly drained, a foundation of hydraulic cement concrete should be used. Care must be taken to make the surface of this concrete rough, to prevent the bituminous pavement from slipping on it and forming depressions and ridges. The simplest and best method now used is to make the concrete slightly rich in mortar, then tamp it until a film of mortar is on the surface of the concrete and immediately scatter over this surface a sufficient quantity of clean, broken stone, of about one and one-half inches in size, to half cover the concrete, and at once tamp the stone, about one-half the depth of the pieces, into the film of mortar and surface of the concrete. These stones will then form keys or teeth projecting into the under portion of the wearing surface when it is laid. This makes a dense, strong concrete foundation, having all voids filled with mortar, and provides a rough, serrated surface, suitable for all kinds of monolithic pavements. This method of laying concrete foundations is more and more used everywhere. It should be required in all specifications for the use of bituminous pavements.

There are several weak and bad forms of hydraulic cement concrete foundations which must be guarded against. Avoid concrete lacking sufficient mortar to fill the voids between the stones. Some contractors lay such concrete not only to save cement, but for the alleged reason of providing a rough surface for retaining asphalt and other sheet pavements from slipping. This not only gives a weak foundation, but permits water to easily penetrate the concrete from below, as on many streets of Buffalo and other places, to the great injury of the wearing surfaces which are thereby often disintergrated or at least displaced by alternate thawing and freezing of the water. The concrete itself suffers by the same actions.

We must prevent a concrete foundation from being roughened on its surface by the bad process of only partly tamping the concrete and thereby only partly displacing the mortar of the concrete and not forcing it up into all voids from its original position in the lower portion or bottom of the mass, which it may take at first. This partial tamping may leave projecting stones at the top of the mass, but such incomplete tamping leaves voids in the concrete. The resulting foundation is not uniform, dense, waterproof, strong nor durable. The surface is not uniformly roughened, but consists of holes and bunches with projecting and loose stones all over it. Thorough tamping is what all engineers insist upon. The evidence of such tamping is a slight excess of mortar forced to the surface of a concrete.

There is another group of foundations which are successfully used with great economy under bituminous pavements. This group consists of old pavements prepared in several ways.

If the old pavement is sheet asphalt. asphalt blocks, brick, stone, wood blocks or other pavement with a firm foundation of concrete, crushed stone or their equivalent, the best way is to remove the old pavement down to the upper surface of the fundation. Then, if needed, build up the foundation with a bituminous base of at least three inches thickness, laid as already described. But when there is not room for this, then lay a dense binder of not less than one nor more than three inches thickness. The bituminous pavement wearing surface is then laid upon the foundation, built up in one of the two ways just described.

If the old pavement is of brick, cobble or stone block, and at the same time sufficiently low to permit being surfaced with bituminous pavement, these old pavements can be used for a foundation by having the blocks and the joints between them well cleaned. A binder, such as I have described, is then laid over the old pavements, to a sufficient height to leave two inches for the wearing surface.

If the old pavement is macadam at a height, thickness and quality suitable for a foundation, it can be brushed clean, built up to the grade desired with clean, crushed stone. This new surface must be rolled with a very heavy steam roller, then coated with a suitable bituminous cement. The old macadam thus becomes a bituminous base.

The foregoing briefly describes the best methods in general, successful use, for preparing foundations for bituminous pavements. There are others, some very complex and expensive, with no advantages over any of those described. There are still others which are positively bad in principle and worse in practice; for example, coating the surface of a hydraulic cement concrete foundation with a bitumen. This has been tried and is a positive detriment; among other reasons because the bitumen cannot run down into, but gathers in small pools on, the concrete. It soaks upwards and softens many spots of the wearing surface, causing the pavement to wear unevenly as well as to slip on the bitumen, softened by the heat of summer. The surface of a hydraulic cement concrete should never be coated with bitumen, whether asphalt or other bituminous cement. It is also a useless expense. A concrete foundation can be made strong and with a rough surface by the method of thorough tamping I first described.

WEARING SURFACES OF BITUMINOUS PAVEMENTS.

, The upper layer about two inches thick, being subjected to the direct wear of traffic and weather, is called the wearing surface. Let us consider some of the essential principles needed for the construction of successful bituminous pavements containing crushed stone.

A brief glance backward shows how new this general kind or type of pavement is. Although there had been earlier attempts in England and France, it was not until about 1880 that a small amount of roadway was surfaced with definite, experimental mixtures of crushed stone, pitch and tar. This was in Europe, as well as the later experiments of mixing crushed stone with rock-asphalt in Germany and France, with the hope of making the asphalt pavement less slippery.

Several attempts were made in America of laying mixtures of stone and gravel with tar and asphalt. They were nicknamed "poultice pavements" and failed. About 1899 the late F. J. Warren began to investigate compounds of stone and bitumen, to learn the causes of previous failures and how to succeed. He made a distinct advance in this art. What is known as the bitulithic pavement is the result of his researches. He invented some new machinery and process and mixtures, and insisted upon certain qualities of the crushed stone and bituminous cements used. Therefore, the pavement laid under his formula is thus far the best one of the general group of crushed stone bituminous pavements. The success of his special pavement has naturally caused great efforts, not only in the United States, but in several foreign countries, to either imitate it or evolve a substitute; especially because his machinery, processes and mixtures are patented or protected by trade-mark and copyright. The present results of imitating are patent lawsuits. Substitutes are thus far not successful, although a great improvement over previous practice.

By whatever process produced, a bituminous crushed stone pavement, to be successful, must meet the following requirements: It must have maximum density with minimum voids; the stone used must be durable, to resist wear; the crushed stone so proportioned in a descending scale as to have each successive smaller size fill the voids between the larger sizes down to the finest powder, and have these stones mutually support each other; then a cement must be used which is waterproof, adhesive and ductile, not only to cement the mineral aggregate together, but also to fill any possible tiny voids; this is best accomplished by pre-separating the crushed stone into several sizes and storing them in several bins, then taking such proportions of each size from each bin as have been found by technical tests to give a mixture of the greatest possible density of the kind of stone used, or a density as near as possible to that of the original stone from which the crushed stone was made. The result is easily demonstrated by comparing the specific gravity of the stone before it is crushed with the final aggregate of crushed stone. It is not possible to obtain a maximum density by using crushed stone direct from a crusher; nor by filling its voids with some small sizes which are not graded; nor by filling the voids with a mixture of sand and stone dust. Comparisons of the different weights of, say, one cubic foot of each of these mixtures, show at once the lack of weight and consequent lack of density of all mixtures which are not made on the principle of assembling the crushed stone in graded sizes from the largest to the smallest particles. I have examined bituminous crushed stone pavements of several kinds in many cities, some using mixtures on the principle I first described, and others on the other methods I have referred to, and found the above facts to be borne out in practice.

Without going into technical details of the bituminous cements used, I can suggest some of its requirements. It must be uniform as shown by penetration, flow, evaporation and other tests. It must be soft and vicious as possible and still have adhesion and strength sufficient to bind the mineral aggregate together at all weather temperatures, and when subjected to the shock of wheels and hoofs. It must not be volatile at the temperatures used in mixing, which, of course, cover weather temperatures. It must resist water action and be ductile and flexible, as well as remain adhesive at the extremes of winter and summer.

A crushed stone bituminous pavement, when finished, should have a granular, rough surface, so as not to be slippery for people or horses, and to prevent the skidding or sliding of vehicles sidewise. This is very much appreciated by owners of automobiles. It will have this surface composed of as much angular stone as possible to be compressed together.

A special surface finish is applied to the best pavements of the type we are considering. It consists in applying a thin film of a suitable, soft, quick drying bitumen, applied hot, and then spreading on it a thin layer of very fine stone grit. The function of this process is to seal any pores which may exist on the wearing surface, and still leave the surface roughened.

I will close by briefly indicating what must not be done and what I have observed produces weak crushed stone bituminous pavements, which do not give maximum service for minimum cost of construction and minimum subsequent maintenance.

Stone, as I have indicated, as it comes from the crusher is called "crusher run" stone. This is not suitable for making the densest compounds. The different sizes of the crusher run stone are not in the right proportions to reduce the voids to a minimum; nor is such crushed stone constantly uniform in its composition of sizes or arrangement of sizes, even from the same quarry. The use of crusher stone is one of the causes of failures of the pitch and tar macadams of the past which were laid for experimental or other reasons, and are still laid to a limited extent in a few small places.

A very few attempts have been made to construct a pavement of the general type we are considering, by combining crushed stone containing say 30 per cent., or even 20 per cent. of voids, with a bituminous mastic or an asphalt paving mixture of sand, dust and asphalt or other bituminous cement, relying upon this bituminous mastic or mortar to fill these voids in the crushed stone. Such pavements might be called asphalt filled stone or stone filled asphalt pavements. They have not the best qualities of either. Their greatest defect is that the stone ingredients do not interlock and mutually support each other, but are kept apart by, or are suspended in, the yielding bituminous mastic or mortar.

A somewhat similar process was tried in Germany and France and is now being tried, to a limited extent, on a few roads outside of cities. The process I refer to is the use of crushed and ground natural bituminous-rock, called rock-asphalt, as a filler or binder for ordinary macadam. This has not been found economical in Europe, but it may meet with better success under light traffic on country roads where it can be obtained cheaply near the quarries of rock-asphalt.

There are other processes which are impracticable in theory and practice, although they are sometimes described in print, by men who would like to get them tried at public expense. They generally advocate using crusher run stone, mixed with sand and bituminous cement, or with semi-liquid bituminous mortar and then relying upon tamping and rolling to produce a pavement having its voids filled from pressing the mastic or mortar into the voids.

Such pavements do not contain sufficient stone, nor the right proportions of all their ingredients. They produce cellular pavements, with the cells filled with weak, pliable material. They violate the standard engineering principle that wearing surfaces, subject to shock, rolling and other friction, must not have irregular densities. A successful bituminous pavement of the crushed stone type must have all the stone possible concentrated in it, so as to present a maximum resistance to wear, and the bituminous cement must be of right quality and used only in sufficient quantity to cement the mineral aggregate together, fill any interstices and make the pavement weather proof.

THE PRESIDENT: There is an announcement to be made about the photos taken yesterday.

Photographer: Gentlemen, I want to say in regard to the photos we made on the trip are not ready yet, but are excellent. I have a very good negative, and the photos will be finished in 11x14 mount on 16x20 card and will be sent to your address prepaid at $1.25. Now if any of you gentlemen want one, I will be in the hall and on leaving, you can leave me your name and I will forward them to you.

Mr. Owens: Mr. Chairman, there is another paper here from Helena, Ark., about the Oiling of Public Roads, in that city, and I suggest as the time is short that we read it by title and incorporate it in the minutes if there is no objection.

AN EXPERIENCE IN OILING AN UNPAVED STREET.

BY FRANCIS H. WRIGHT, CITY ENGINEER, HELENA, ARK.

The writer does not care to pose as an expert on the use of oil for road purposes, for he is none such, but being anxious to contribute something to the success of the Birmingham meeting, he has assembled a few facts gained from an experience of his own, during the past summer. Every city engineer, especially in a small city, has the usual experiences of dealing with "natural-born" engineers amongst the representative citizens, and there are times when they become quite troublesome. We have a few in our little city, and last summer one of them who had been reading one of the "Good Roads" or something similar circulars found out that they were improving the roads in California by the use of oil upon them.

He was very restless until he had button-holed the city engineer, the mayor and the chairman of the board of public works, and after putting them on the "inside" he induced them to assemble in front of his house where he was able to deliver a "good roads" speech to them in a body. His honor knew that there was so much work to be done around the city and so little to do with, that he was reluctantly persuaded to enter into an agreement with the enthusiastic citizen that the city would bear the other expenses incident to the oiling, if the property owners would pay for the oil for the street.

The city engineer knew that he had no means for handling or storing the oil and that there was considerable other work necessary before the street would be in any condition to oil.

For that reason, he was inclined to dodge, as he also knew that he would not likely get funds enough to do the necessary grading, etc. However, the car of crude oil was ordered, so now the story begins: The street had had some work done on part of it the preceding spring (there were two blocks, about 700 feet in all) and the upper block was a good crown on about a six per cent. grade, and the lower block was a much flatter crown, dropping off on the upper end from the upper block on about an eight per cent. to about one-half way down, then about a four per cent.

There was a total rise of about forty feet in the two blocks, and in heavy rainstorms there had always been very much washing of the gutters and in the wagon tracks on the crown, as the soil was a very soluble yellow clay, Helena being the termination of Crowley's Ridge, which is well known to engineers and geologists of the Mississippi Valley. The street was thoroughly plowed twice for a width of forty feet, the amount used for traffic, the plow being a small pointed Avery with a steel beam. which cost $10 in a local hardware store.

After plowing, a disc harrow was thoroughly applied, after which a toothed harrow was used until the whole street was like ashes. One team only was used on this preliminary work with a driver. but a shaker was used with the plow.

The plowing and harrowing consumed about two days' time.

There was some scheming necessary in order to get the oil from the car. It was thought at first that the gasoline pump in use by the local oil depot would answer the purpose but it was found to be impracticable on account of the waste in frequent startings and stoppings in loading into separate barrels at each trip of the wagon, there being three 52-gallon barrels upright in the wagon-bed.

A small lever pump was bolted to the floor timber of the car at the side of the tank, and a connection was made to the inside of the tank by a siphon through the dome of the tank, made of two-inch wrought iron pipe with the necessary fittings.

The driver with one man to pump was able to leave the street, go to the car and fill his barrels and return in exactly thirty minutes. A strip was taken on one side of the street about fifteen feet wide (the street not being closed from traffic), and three men, each armed with a large two-gallon garden sprinkling can, with spray removed, poured the oil on the pulverized surface, each man working in his own section, about twenty feet long, the driver filling the sprinklers by pumping from the barrels with a tin oil pump.

The writer inaugurated this system of distributing oil during the mosquito campagn of the previous year (1905) and found it very satisfactory.

A load of coarse sand was dropped about every fifty feet on the oiled strip, and during the absence of the wagon in refilling the barrels this sand was spread by the men in the same manner that sand is applied over a newly grouted brick pavement in thin layer.

After one side was oiled and sanded, a strip on the other side was treated likewise, and the center strip was again plowed and harrowed (having become compacted by traffic) and also treated, after which the whole street was run over with a toothed harrow, and was then gone over and oiled and sanded a second time but was not harrowed. The street was then thrown open to traffic.

This was all done the first week in July, and until recently, there has been comparatively little dust, and no mud, nor has there been any more washing where formerly it was excessive after a hard rain, and we have had several this summer, one quite soon after the street was treated. I am of the opinion that the oil should have been renewed within sixty days. We were, I think, fortunate in having rather hot weather in which to apply the oil. The gutters have still a good percentage of the oil retained, and the sod was enabled to take a good set, which, of course, reduces the wash.

Time was taken in unloading one wagon (three 52 gallon barrels), and it took three men exactly one hour to dispose of the load over a surface of 15 by 100 feet, or 1,500 square feet.

One man scattered with a shovel one wagon load (about 24 cubic feet) of sand over an area of 50 by 60 feet, or 3,000 square feet in fifteen minutes. The cost was as follows:

(The oil was charged at $1.59 per 44 gallon barrel.)

Team, 7 days at $3	$21 00
Labor, 11 days at $1.25	16 75
Foreman, 3½ days at $1.50	5 25
Total labor account	$43 00
Oil, 47.14 barrels at $1.59	$74 95
Sand, 35 loads at 75 cents	26 25
Total materials	$101 20
Total, all items	$144 20

I thank you, gentlemen, for your attention.

THE PRESIDENT: The next paper on the program is on "Paving and Paving Materials of the Southwest," by Mr. Reichardt, of Little Rock, Ark.

PAVING AND PAVING MATERIALS OF THE SOUTHWEST.

BY WALTER F. REICHARDT, LITTLE ROCK, ARK.

Owing to the many kinds of pavements in use and the vast amount of paving material found in the southwestern states, the writer will be compelled to describe each in brief manner and will not go into detail in discussing the specifications but will endeavor to give to this Society the results of investigations and tests of the quality and properties of paving materials as found in these states and the various methods of construction of pavements made of these materials. This discussion will deal mostly of pavements in use in cities ranging from 10,000 to 50,000 population, as this size city is the one mostly found in the above states and is one with which most engineers come in contact.

The most common pavement found in the southwest is the brick pavement, and on account of the various grades of material used and the different methods of construction this pavement is very interesting and will be given first discussion.

Paving bricks are manufactured in a number of cities of the southwest, but the best grade comes from Kansas and Arkansas, the former being the better brick. In the City of Pittsburg, Kan., there are two companies making paving brick, and while both are made in the same city and in practically the same locality, almost an entirely different grade of brick is obtained. In the manufacture of paving brick, as in the construction of the brick pavement itself, different results are obtained with the same materials, due to the difference in handling same. In the case of the Pittsburg brick, one is soft and does not stand wear at all, while the other is hard and absorbs but little water and stands traffic very well.

The writer has found the methods of construction of the brick pavement to be of more interest than the manufacture of the brick itself, and will show how different are the ideas of engineers and city officials in various localities and the results obtained.

In the State of Arkansas, where the writer has practiced mostly, the brick pavements have been constructed in the past on a very cheap basis. In most cases no foundation other than the natural earth has been used. In the City of Little Rock two brick pavements were constructed about fifteen years ago, on a clay or natural earth foundation and remarkable results have been obtained. In the construction of this class of pavement the subgrade was prepared just as though a concrete foundation was going to be used. After the subgrade had been properly rolled, a cushion of sand about 1½ inches was spread on top, after which the paving bricks were laid on edges and the joints filled with sand.

In the case of the above city these two pavements have given excellent results and it is doubtful if the other brick pavements in that city constructed on concrete foundation will give much better ones. In the City of Fort Smith, Ark., where one of the largest contracts ever let for paving at one time, the pavements in most cases will be brick and will have no other foundation than the natural earth with a four-inch sand cushion. The bricks will be laid on edges and will be thoroughly rolled with a heavy roller. The price for this class of pavement was 83 cents per square yard, which is exceptionally cheap for any kind of pavement.

Another method of constructing brick pavements that has struck the writer very forcibly as being one of the best, if not the best method, is that one that is in use in Pittsburg, Kan., and is one with which the writer has had some experience while city engineer of that city.

I have been informed that this method has been used by other engineers and has given good results. In the construction of this class of pavement the subgrade is prepared in the usual manner, great care, however being taken to remove all soft and spongy places and refill same with good material. On top of the subgrade is spread a four-inch layer of cinders which are sprinkled and thoroughly rolled with a roller weighing not less than five tons, after which a layer of hard burned vitrified brick is laid flatwise and close together. with the long edge parallel to the curb line. Then on top of this platen course of brick is spread a one-inch layer of sand which is shaped to the finished contour of the pavement by means of templets making the pavement ready for the top layer of brick or wearing surface. The top layer is composed of the best hard burned brick and the bricks are laid on edges with a sand filler.

After the joints have been filled with sand a thin layer of sand is spread over the entire surface. In rolling the top layer a roller weighing not less than five tons is used and that part of pavement that cannot be rolled is thoroughly tamped. The contract prices for this class of pavement, as was paid on the construction of two large districts, were $1.20 and $1.26 per square yard.

In the opinion of the writer this method makes an excellent pavement, and judging from one of these pavements that has been in use for more than fifteen years in Pittsburg, this pavement will last as long as any other kind of brick pavement. Owing to the fact that this pavement can be constructed at such a small cost and that it is not near so noisy as the brick pavement laid on concrete foundation, this method of construction will become very popular in this section, especially where brick can be secured at a reasonable cost. When the top layer or wearing surface becomes worn, the old layer can be replaced by a new one without disturbing the foundation or platen course.

The method that is perhaps most used in the larger cities and that is being used to some extent in smaller ones also, is the laying of brick on a concrete foundation with sand cushion.

This method is more costly than any other both from the cost of material and supervision necessary to secure good work. The subgrade is prepared in the same manner as in the above methods and a five-inch layer of concrete is laid for the foundation. This is generally mixed in the proportions of one part Portland cement, three parts clean sharp sand and five parts crushed stone, the largest of which will pass through a 2½ inch ring. On top of the concrete is spread a cushion of sand varying from one to two inches in thickness. after which a layer of hard burned paving brick is laid on edges and then thoroughly rolled. After rolling, the joints are filled with cement grout, pitch or asphalt filler.

The writer seems partial to the pitch or asphalt filler, as the pavements which he has investigated and are filled with cement grout, appear to be very noisy pavements. The cost of this class of pavement, where crushed stone is plentiful, varies from $1.80 to $1.90. However, in Fort Smith the price was $1.46 per square yard.

In the construction of brick pavements under the last method the writer found that great care must be taken both in selecting the material and supervising the actual construction in order to obtain a good pavement, and found in some instances where the specifications had not been properly carried out and that the surface of the concrete foundation was not of the same contour as the finished pavement. This latter defect being due in a great measure to carelessness on the part of the engineer who probably did not give sufficient grade stakes or else did not see that the work was not carried out according to the stakes which he had given. Another error often found in this construction is that a proper cushion joint is not left next to the curb. and as no allowance is made for expansion. the pavement raises or cracks in the center. This is also very noticeable where brick is laid between car rails.

A pavement that is becoming more popular in the southwest is the asphalt pavement and this is due to the fact that a very fine grade of rock asphalt has been found in these states. Of asphalt pavements now being laid, rock asphalt seems to be in the majority, as it has been shown that this grade will stand the warm temperatures.

The rock asphalt is found in large quantities in Arkansas and the Indian Territory, the former being richer material, and the writer believes will stand more wear. The Territory asphalt has been used a great deal in Texas and has given good results, while the Arkansas material has been used only in that state.

The rock asphalt pavement is constructed in same manner as the old asphalt pavements with the exception that a binder course is not used. The asphalt is ground.. after which carbonate of lime is added and the mixture dumped into a mixer. After the material has been thoroughly mixed, it is shoveled into the heater where it is raised to a temperature of 250 to 300 degrees F. It is then hauled to the street where it is raked and rolled as in any other asphalt pavement.

In the mixing of rock asphalt great care must be exercised as the material as a general rule runs irregular in percentage of bitumen and therefore requires constant testing in the laboratory. The amount of carbonate of lime that is added to the mixture of course depends upon the percentage of bitumen that the material contains. The writer has used the Territory, Arkansas and also the Kentucky asphalt and finds that a good pavement can be had from use of each kind if it is properly handled and that no fixed rule can be applied the handling of any as constant experimenting and testing of each is required. Of the three asphalts mentioned the writer has found the Arkansas material which is the richer material, to be the easiest handled and owing to its large amount of bitumen is exceptionally good for the asphalt macadam.

The asphalt macadam has become very popular and owing to its small cost as compared to the other pavements will become more popular and will be used extensively in residence districts. An asphalt macadam has the same appearance as that of the sheet asphalt and is as easily kept clean, its surface being smooth but not slippery.

The Arkansas Rock Asphalt Co.'s macadam with which the writer has had experience is constructed as follows: The subgrade is prepared in the usual manner, however great care is taken in removing the spongy places and refilling with good material and is thoroughly rolled. On top of the subgrade is spread a 3-inch layer of stone, the largest of which will pass through a 2½-inch ring. This layer is then thoroughly rolled after which a one-inch layer of sand is spread and rolled thereby filling to a great extent the voids of the stone. On top of the sand and stone is placed another three-inch layer of stone, of the same size as base material. The entire pavement is again rolled and is then ready for the wearing surface, which is three inches in thickness and consists of a mixture of ground rock asphalt and crushed stone, the largest of which will pass through a one-inch ring. After this mixture has been spread the entire pavement is again rolled with a heavy roller, and after sprinkling or sweeping cement over same the pavement is ready for traffic. This pavement increases in hardness by the traffic as it becomes more packed.

The cost of this pavement in the City of Little Rock where crushed is plentiful, was $1.40 per square yard.

This macadam is not an experiment, but has been proven to be a popular pavement as well as a lasting one. However, this like all other pavements requires attention and must be kept clean as we all know water and filth causes deterioration of any pavement.

An advantage that the macadam has over the sheet asphalt pavement is that it is not slippery, and never becomes so, the stone in the pavement affording a footing for the horses.

Another pavement used to some extent in the above section is the bitulithic, and like all other pavements has given both good and bad results. In the business districts of some of the old cities we find the granite block pavement which, in most cases, have been down for years and are still good for many more years. This class of pavement is intended for streets over which there is traffic of heavy wagons and therefore should only be in wholesale districts. This pavement is as much out of place on a main street where there is traffic of light vehicles only, as an asphalt pavement would be at a wharf or in a wholesale district where the calks on the mule's shoes cut and wear the pavement in a few years. The writer is of the opinion that the cities in this section now having the granite block pavement will replace same with asphalt or some other good pavement, excepting where the granite is in wholesale districts.

The wooden block pavement has been used in but very few cities and in some cases have not proven a success, but if the blocks now being laid in the East were used this pavement would become very popular.

As a general summary the writer will state that paving has to a great extent been neglected in the Southwest, but that more work has been done in this line in the past three years than any time previous and that with the good roads movement on throughout all sections of the country, there will be greater activity in street paving throughout, and no city can become great without good pavements, as good streets make any city.

Have also noticed that most of the cities are without street cleaning departments and that the streets are practically neglected and are not kept in a good and sanitary condition. This perhaps more than any other cause is the reason why so many pavements fail and do not meet the requirements. For this reason asphalt pavements have not been used as much as other pavements as this pavement must be kept clean and sanitary to give good results.

Owing to the large amount of oil in the Texas fields the use of oil on macadam roads has become popular and is used a great deal and with good results in small towns where the more costly pavements can not be laid. Chert and trap rock are found in Missouri and Arkansas and are excellent materials for macadam.

The writer has endeavored to show the Society and especially the members of the Northern and Eastern states the many methods used in constructing pavements in the Southwest, and the vast amount of paving materials to be found in this section and hopes that it will bring out discussion by which the Society as well as himself will profit, and it is to this end that he has presented this paper.

THE PRESIDENT: We have one more paper on the Tests of other woods than yellow pine for block pavements by Mr. Kummer, New York.

MR. KUMMER: I think in as much as it is so late it would be well to read that paper by title.

THE SECRETARY: I think we would like to hear that paper.

TESTS OF OTHER WOODS THAN PINE FOR PAVING PURPOSES.

F. A. KUMMER, 29 BROADWAY, NEW YORK, N. Y.

The increase in the price of long leaf yellow pine since the year 1900, at which time the company with which I am connected first began its purchase for paving block purposes, has been quite 50 per cent. I remember distinctly buying five and six years ago large orders of one million feet or more of all heart, long leaf, Georgia pine at considerably less than $20 per M. delivered at New York, while inferior grades of lumber to-day command a price of about $30 per M. It will readily be seen that a difference of $10 per M. feet adds 36 cents per square yard to the cost of 4-inch block. Wood pavement being already the most expensive pavement in the market—at least so far as first cost is concerned, this heavy increase naturally to some extent has limited the market for this character of pavement. Not only has this been true so far as price is concerned, but the quality of the lumber obtainable has also decreased. Five and six years ago the material which we purchased for paving block purposes was cut from the best part of the tree and was dense, solid lumber, usually cut from trees of fairly large size. The lumber we get to-day contains a small proportion of sap wood, which is undesirable, and is usually cut from the tops and smaller parts of the tree and from smaller trees; and for this and other reasons is less dense in quality and requires more care and expense in treatment to bring it up to the standard which is called for by the best specifications. Appreciating these conditions, not only individual manufacturers of wood block, but the Bureau of Forestry of the Department of Agriculture have been conducting tests to determine what other woods of those available in this country can be successfully used for paving block purposes. The first test of this character of any size was arranged between three parties, viz.: The Department of Agriculture, the Kettle River Quarries Company of Minneapolis, who are manufacturers of wood block, and the City of Minneapolis. Without going into the exact details of this test it has been arranged to lay a section of pavement in Minneapolis upon which the several kinds of wood are to be tested in comparison. Among these are Norway pine, which has been extensively used in that part of the country for street paving work, and tamarack, which has had a much less extensive use for this purpose, but promises excellent results. This test, which is to be made on a heavily traveled street, should show much both as to the quality of these woods and the best methods of laying them—as in the test different forms of construction will be used. The writer does not feel at liberty, however, to go into a description of these tests at any greater length, as in advance of the results which the parties at interest may have to give out it would not be proper to do so.

Early this year the same arrangement was suggested by the Department of Agriculture, Bureau of Forestry, with the U. S. Wood Preserving Company and the City of New York, the purpose being to test against long leaf yellow pine not only short leaf pine, but tupelo, loblolly pine, maple, sap gum, scrub pine and scrub oak. This test was to be somewhat similar to that made in Minneapolis, although embracing different varieties of wood and a different arrangement of the variables which could affect the construction; such, for instance, as the question of laying blocks on sand cushion or mortar bed; the best form of joints to be used between them and whether the blocks give better results laid straight across the street or laid at an angle with the curb. The arrangements for this test have not yet been perfected, although this is not in any way the fault of the City of New York or the Department of Agriculture, but is due to delay on the part of the wood block company, who are not yet quite ready to undertake the experiment as proposed, pending other tests which are now being made. The writer has some doubts as to the value of tests on scrub oak, maple and some of the other woods named, as it is questionable whether they could be secured in large quantities, commercially, at reasonable prices—although in this respect there seems to be a confliction of opinion.

There is one wood, however, with which we have made some extended experiments in New York City with very satisfactory results. This wood is what is known in the South as black gum. The source from which we are now obtaining it is Norfolk, Va. and vicinity, but it no doubt exists in other localities in large quantities. Unlike red gum, it has not been particularly valuable for any general use, owing to its very irregular and crooked grain and the difficulty of properly seasoning it. One city block between the tracks of the Metropolitan Street Railway Company on Hudson street, New York, was laid with this pavement about a year ago. The joints between the blocks were filled with paving pitch. They were laid on a cement mortar bed on concrete, as usual. They have given perfect satisfaction in every respect, have shown no tendency to swell and have worn, if anything, even better than the pine in the adjoining track. This wood, which is materially cheaper than pine and promises to remain so, possesses some advantages as a paving material and some disadvantages. Among its advantages may be named its extremely tough and close grain, making it not only a very durable block, but also one which does not split readily. This is an enormous advantage to the manufacturer as waste in cutting, handling and shipping pine blocks is extremely large. Among its disadvantages may be named its greater weight in shipping, the greater length of time required to prepare it for treatment by driving off the contained moisture, and the fact that when this moisture is driven off the blocks require a greater amount of preservative per cubic foot to thoroughly impregnate them and fill up all the pores.

This wood is now allowed in the specifications of the boroughs of the Bronx and Queens in the City of New York, as an alternate for pine, and the U. S. Wood Preserving Company has recently taken the contract to lay a street containing somewhat over sixty thousand square yards with this wood in the borough of the Bronx. Large shipments have also been made to Bridgeport, Conn., to Holyoke, Mass., to Springfield, Mass., for the main street there, and to Boston for the Boston Electric Railway for track work on Beacon street. Lexington avenue, New York City, from Forty-second to Seventy-second streets, between the tracks of the Metropolitan Street Railway Company has also just been paved with this material, and sixteen thousand square yards are now being shipped to Boston for street work. A contract has also been let to lay this wood on Green street in Baltimore, Md. The specifications of the City of Cincinnati also permit the use of this wood as an alternative of pine, as do also those of a number of other places which I will not now mention.

The writer enumerates these examples of the use of black gum to show the very large extent to which this wood is now being used, a fact which no doubt will be new to you all.

In any determination as to the value of a wood for paving purposes, if we start with the assumption that by filling the pores of the wood throughout the block completely with a good quality of creosote oil, decay can be prevented. There remains only one other question to be decided and that is whether the wood is sufficiently dense, tough and hard to successfully resist heavy travel. Such a determination is not a very difficult matter. In fact, it is almost self-evident that using Georgia pine as a standard, any block which is as hard or harder than this wood should give equally as good or better results, while those blocks which are not so hard—such, for instance, as short leaf, loblolly and Norway pine should give less satisfactory results. The writer believes that all these woods can be used for paving purposes if properly treated, but should be used with discrimination. A street laid with loblolly pine under moderate travel might readily give a serviceable life of twenty years or more, while a similar pavement under the excessively heavy travel found on such streets as exist in the lower part of New York City would probably be destroyed very quickly. The length of life of a wood block pavement is not directly proportional to the travel. Take, for instance, two streets laid with the same wood, in the same manner. If the traffic on one street approaches but does not reach the limit of durability of the wood, the pavement will last almost indefinitely because the character of the traffic is not sufficiently heavy to destroy it; but if this traffic in its character as well as amount passes the limit of durability of the wood employed, the pavement will be destroyed in a comparatively short time. It would seem that for each class of timber there is a condition of traffic beyond which it should not be subjected, but no determination of these limits could correctly be made except from a great number of actual service tests. In a general way, however, satisfactory results may be obtained by dividing the streets into three classes: heavy, medium and light travel. On the third class of streets practically any wood which would not decay would give an indefinite life. On the second class discrimination should be used, although woods as soft as Norway pine have given excellent results under these conditions. On the first class of streets it would probably be dangerous to lay any wood less durable and resisting than the best quality of long leaf pine. So far the writer does not know of any available wood other than the black gum before mentioned which could be safely included with long leaf pine in this category. By this, of course, is meant woods which can be obtained in large quantities commercially, and which possess the element of toughness rather than that of extreme hardness.

While in Havana last July the writer saw a street—San Rafael street —beautifully laid with native hard woods, mostly mahogany, untreated.

The surface of this pavement was almost as smooth as glass and excessively slippery, so much so, indeed, that large areas of other streets in the city paved with the same material have been gone over by workmen with small chisels, who have cut the surface of the pavement into a sort of checker board of grooves so as to permit horses to safely travel over it. A somewhat similar, although not so extreme condition has existed on many streets in London laid with Australian hard woods, and the slipperiness of these woods has been the reason why they have so largely been laid with a wide joint between the blocks, this joint being filled with pitch and crushed stone or gravel so as to give horses a foothold. The result of laying pavements in this manner is soon to give a rounded or cobble stone effect, due to the edges of the block wearing off, thereby destroying one of the chief advantages of a wood block pavement. The practice of laying blocks with a tight joint is increasing in London as the use of the Australian hard woods is decreasing. It will thus be seen that the element of toughness and durability in a block is not the same thing as extreme hardness of the wood. Beyond a certain limit many woods are too hard to make a successful paving material.

Among the woods listed for the proposed test by the Department of Agriculture in New York, above referred to, it seems improbable that there will be found any woods possessing the advantages of either long leaf pine or black gum for paving material. The scrub oak, if it existed in large quantities, might make a very durable wood but for the fact that oak, owing to its great tendency to split when subjected to heat, is a very difficult wood to treat. Maple, the writer is inclined to believe, would prove slippery, and Virginia pine, loblolly pine, short leaf pine and the other inferior grades of pine would not make blocks suitable for the heaviest travel.

The writer recently tested a number of South American woods, some of them so hard and dense their absorption under the usual time of treatment was only four pounds of creosote oil to the cubic foot, running down to others which absorbed forty pounds. Some of these woods may prove useful for paving block purposes, but the great difficulty would be in separating the different kinds of wood. The tropical forests contain from twenty to twenty-five different kinds of woods, indiscriminately throughout the forest and not in large bodies of any one kind of wood. In getting them out these forests can only be successfully operated by taking out everything, thereby clearing the land for agriculture purposes, and with 15 or 20 kinds of wood which may be valuable for paving block purposes, the manufacturer would be obliged to separate these woods into several different classes having approximately the same toughness and durability, as otherwise the pavement would naturally wear very unevenly. The writer believes, however, that from this source some very excellent materials can be obtained for street paving purposes. A large enterprise is now under way to get out lumber of this character in the United States of Columbia, and some of it should be on the market in the course of another year.

The Douglas fir, or Oregon pine of the Northwest, is almost an ideal material for general paving block purposes. It is not quite so hard or tough as long leaf yellow pine or black gum, and for this reason will probably be excluded from streets of the most extreme travel; but with the exception of perhaps a very few streets of this character it would prove equally satisfactory, and possess the great advantage of being extremely regular and homogenous in texture so that the differences between hard and soft wood found in the smaller long leaf yellow pine trees would not exist and pavements could be laid which would wear with perfect regularity throughout their entire surface. There is no opportunity to secure this wood for paving purposes east of the Mississippi River at the present time, but with the completion of the Panama Canal it will no doubt become a very extensively used wood for all purposes in the eastern part of the United States.

Quite recently another wood has been suggested for paving purposes of which the writer has very little knowledge, either as to its physical properties or its availability. This wood is chestnut oak, which is found in Western North Carolina, Eastern Tennessee and Kentucky, and Northern Alabama. It resembles oak, but is softer and less rigid of grain. No experiments have been made with it, but it promises to make a good wood for paving block purposes if it can be obtained in large quantities at a reasonable price.

Recently the writer had a talk with Mr. B. T. Fendall, one of the members of this Association, and the city engineer of Baltimore, Md., who had just returned from a trip of several months through England and the continent, inspecting foreign methods of paving.

Mr. Fendall stated that he had nowhere in his travels seen as good wood pavements as those now laid in the City of Baltimore. This he attributes first, to the fact that the woods used, Norway and Swedish deal, Pyrenees pine and native French pines are softer than the long leaf yellow pine used in this country, and also to the fact that the blocks are not so thoroughly treated—only 10 pounds of oil to the cubic foot being used as against our 20 or 22 pounds.

Mr. Fendall also exploded some of the prevailing notions about the foreign pavements—notions which are very common and widespread in this country. One of these is the idea that the English or continental engineers use extremely heavy concrete foundations under their pavements. This is not true. The heaviest concrete that Mr. Fendall found anywhere abroad was 7½ inches in Germany, and the usual practice is six inches, generally gravel concrete. Most of these streets have been paved with macadam for many years and consequently when the sub-foundation is cut through the macadam sub-base looks like concrete and gives a wrong impression to the layman. Any engineer would know that foundations 12 or 14 inches thick, on ordinary well compacted sub-grades, would be only a waste of material.

Another point which impressed Mr. Fendall forcibly was the question of repairs. It has been stated time and time again that the foreign streets are so well kept up that repairs are always made with extreme promptness. Mr. Fendall did not find this the case and cited several of the principal streets in Paris with many bad places in them and in need of repairs. He attributes these holes to the use of woods not homogenous in character and to imperfect treatment which allows some blocks to develop heart rot and quickly affect the surrounding pavement. This action of traffic on streets is one which affects largely the class of timber which can be utilized for street paving work. The writer has found from long experience that streets laid with blocks, some of which are hard and some soft, will wear very badly while the same street laid with all soft blocks would wear very well. This is due to the well known way in which one soft block will affect its neighbors, the wear extending from the one spot like a disease. The most perfect example of this that the writer has seen was in Havana this summer. The United States Wood Preserving Company, some five or six years ago, furnished to the highway department of the City of Havana, several hundred yards of yellow pine block for a test on one of the heaviest traveled streets in that city. These blocks were of the old size 4-inch by 4-inch by 8-inch and in laying them careless workmen sometimes put them down with the grain horizontal instead of vertical. The street in question has a very heavy travel of two-wheeled carts carrying heavy loads. Six blocks were laid in this street the wrong way. At the end of some five years there were six shallow depressions in this street some 24 inches in diameter and perhaps 2½ to 3 inches deep, perfectly regular and having at the bottom of each, in the exact center, a block laid the wrong way. With the exception of these six holes the street is in perfect condition. This shows clearly the way in which a soft block or a block wearing more rapidly than the surrounding blocks will infect, as one might say, its neighbors.

There is a general, although erroneous, idea widespread in this country, that abroad the bulk of the paving is done with Australian hard woods. This is by no means true. The use of these woods is decreasing abroad. The English engineers have almost given up the use of the Karri wood, although Jarrah is still employed to a considerable extent. It is laid untreated, with an open joint to prevent slipping, as above stated.

On the continent, especially in Germany, tallow wood is liked better than either of the others, but none of the three are in great favor. Mr. Fendall learned in Germany that the German engineers use large quantities of wood laid with close joints, on grades, because this pavement is less slippery than asphalt. It is fair to say that the asphalt employed is rock asphalt.

So far as our experience has gone is seems true that the best woods for paving block purposes are those which are dense and homogeneous, with little, if any, difference between the durability of different parts of the block, tough rather than hard, and capable of treatment without danger of warping or splitting.

In addition, from a commercial standpoint, it should be necessary that such woods are obtainable in large quantities at reasonable prices. At this time it is safe to name four, in the order named: Long leaf yellow pine, black gum, Oregon pine, Norway pine. Beyond these it is not certain what the results may be, although short leaf pine and tamarack have both been used in limited quantities, and the writer sees no reason why they should not be successfully employed if used on suitable streets.

The question is one upon which continued experimentation will throw more and more light as more tests are made and more results tabulated. To draw general conclusions from insufficient evidence is as useless in this as in any other subject.

THE PRESIDENT: All these papers on the subject of paving are now open for discussion. If the Association would like to hear the paper read on "Earth Settlement in City Streets," by Horace Andrews, Consulting Engineer of Albany, N. Y., it will be read.

EARTH SETTLEMENT IN CITY STREETS.

BY HORACE ANDREWS, CONSULTING ENGINEER, ALBANY, N. Y.

This paper is in large part, a compilation of material that exists in a very scattered condition. The writer has endeavored to make his practical recommendations a summary of the best usage and has drawn upon his own experience in many years of observation with clayey soil and a severe winter climate.

COMPOSITION OF SOIL.—The composition and physical characteristics of the soil upon which buildings and street pavements rest influence the permanence of these constructions.

Geologists define a rock as "any bed, layer, or mass of the material of the earth's crust," but as this word in common language is understood to apply solely to the consolidated material, it is better and more usual to employ the words soil or earth to distinguish the loose material derived from the disintegration of the harder rocks.

From the agriculturist's point of view the physical properties of soils have been investigated with great care, less attention, however, seems to have been paid to the causes of their shrinkage and expansion which are of more importance to the engineer.

The soil consists of "(1) mineral grains of various sizes, grouped in different ways and either insoluble in water or soluble with difficulty, (2) the water which covers the soil grains and contains in solution a varying amount of the soluble soil constituents and (3) the soil atmosphere, differing only slightly from air in composition and saturated, usually, with water vapor."

TEXTURE AND STRUCTURE.—The texture of the soil refers to the different size of the soil grains while the arrangement of the grains in respect to one another has been termed its structure. By a change in structure of any particular soil, the change in the mean size of the interstitial spaces is understood; when a soil shrinks these spaces must diminish in size while their enlargement will also increase the entire volume of the soil.

A gravel soil of very coarse texture may have the same percentage of voids as very fine sand. By mixing soils of different texture together the percentage of voids may be diminished, whether the separate grains are large or small, provided that the smaller grains will just about fill the voids between the larger. "In a heavy clay soil, one-half of the dry weight may be made up of soil grains as small as 1-25,000 of an inch in diameter" (King).

WATER IN SOILS.—If the spaces between the grains of a soil are entirely filled with water, the grains are generally capable of being moved more easily by packing or ramming the soil. When thus consolidated the soil is said to be puddled. "When a fine grained soil is thoroughly puddled, all of the small clusters of grains are completely broken down, and the smallest particles are packed in between the larger ones until its cavities are so completely obliterated that even water will not penetrate it" (King). However compactly puddled a soil may be, its water contents will be large, and when the water is lost by evaporation the soil grains seem capable of approaching each other, as is noticeable in the shrinkage of clay. Hence it may be concluded that the water in the interstices actually holds the grains apart.

Puddled material may hold its grains so completely filled with water that little free air is present, except that absorbed in the water itself. This "water-logged" soil is of great importance in the construction of embankments to retain water, as in reservoirs, in which position it readily maintains its puddled character.

Prof. F. H. King, in his work on "Irrigation and Drainage," gives information as to the capacity of soils to store water. "A fine sand which held in the first foot above the ground-water 23.86 per cent. of its dry weight of water, at 8 feet above was found to hold only 3.14 per cent. of the dry weight"; a cubic foot of the dry sand weighing 105 pounds. The loss he attributes chiefly to downward drainage or percolation and also to upward capillary movement and surface evaporation. Many soils when they become very dry, develop shrinkage cracks, but repeated small applications of water will again saturate the soil to some degree and it will then expand and close up the shrinkage cracks. Prof. King comments upon the drying of clay soil as follows: "The firm hard character of a clay soil when it loses its moisture is due to the fact that the grains are so small and so close together that the little material which is held in solution in the soil-water cements them together when dry. Were the grains large like those of the sands, with few of the fine particles between them, the contract areas would be so few and so small that little binding could result."

This theory of Prof. King is not entirely corroborated by the experiments in the Road Material Laboratory, Department of Agriculture, for

Mr. A. S. Cushman, commenting on the cementing value of the powders of various rocks, says: "Rocks which, on chemical analysis, show themselves essentially identical in composition frequently vary widely in cementing value." He considers the classification of materials according to the size of the particles into silts and clays to be incorrect and shows that powdered glass in the finest state of subdivision has no cementing value whatever. The difference in cohesion that exists between various materials in the same state of subdivision does not yet seem to have been adequately explained. Mr. Cushman's experiments show that high cementing values have a decided tendency to accompany a high water content but exceptions occur. As regards shrinkage. it would seem to the writer as if capillary attraction, in clays, where the texture is very fine, may serve to keep the grains apart until the water content is removed by evaporation, when they come more closely into contact. In a letter to the writer, Mr. Cushman remarks: "In general I think it safe to say that a clay that holds a high percentage of water, when *air dried* will usually have a high shrinkage and vice versa. I am inclined to the belief that the shrinkage is a function, and therefore to some extent a measure of the colloidal constituents of the clay or soil."

In cities, a lowering of the ground water is usually effected by the construction of sewers. Baldwin Latham remarks in this connection: "The mere fact of carrying out a system of sewerage, and being obliged to cut through various strata of a more or less retentive character is naturally a means of securing to a great extent subsoil drainage," and he goes on to show the importance of securing subsoil drainage by special means. Folwell states that with the best of cement joints with pipe sewers laid in wet ground, the leakage may amount to from 5,000 to 20,000 gallons per day per mile of sewers, and he adds: "In very many systems it is more than ten times this amount."

Prof. King points out that "when the deeper clays dry out, as they will after underdrainage, shrinkage checks form in them in great numbers opening tiny fissures through which the air moves more freely with every change of temperature and pressure of the atmosphere above." This tendency of the soil to breathe with change of temperature and barometric pressure is of great hygienic interest, in the presence of foul sewers and leaking gas mains, but as concerns the subject of this paper it is of interest as denoting an increased probability of the evaporation of moisture and a corresponding shrinkage.

By simple percolation, without the breathing of air into the soil, a rapid initial drainage occurs, after which the loss of water is extremely slow, especially in soils of fine texture. Prof. King shows this in a table in his work above cited, where it appears that in a column of very fine sand completely saturated, and eight feet in depth, over 10 per cent. was still retained at a point four feet below the surface at the expiration of two years. The original water contained in this sand when saturated was 24 per cent.

Effect of Frost.—The effect of freezing in expanding soils will serve as an index to the water content and will further indicate that a loss of this water by evaporation or drainage will prevent lifting by frost. Where man-holes are built in sidewalks the effect of frost is frequently visible in a raising of flag stones above the man-hole rim. This lifting has been observed by the writer to amount to as much as two inches. The specific gravity of ice is about 0.92; one cubic foot of water will become 1.087 cubic feet of ice. Soil containing 20 per cent. of water in its interstices might therefore reasonably be expected to rise about 0.1 feet when it freezes to the depth of 3½ feet. The necessity of maintaining a dry foundation in such cases is obvious.

It is shown, in the levels taken on the asphalted surface of Center market in Albany, hereinafter referred to, that frost at its first occurrence may raise the surface and that this raising will be permanent. Many brick pavements are cracked in a manner difficult of explanation except by the raising action of frost. Pavements laid on dry soil and specially where a period of many weeks allows of some lessening of the water contents, by percolation, before severe frosts occur, seem less apt to suffer from the lifting effects of frost.

Compression Under Loading.—In founding buildings on natural soil it is customary to ascertain the compression under a measured load resting upon a given area, usually one square foot, and when the bearing power of the soil has been thus ascertained a conclusion is reached as to the permissible load per unit of area. In most municipal works, and more especially with street pavements, the load per unit of area is very small and the natural soil is amply able to bear its load, when suitably protected by the hard surface of the pavement.

Very dry materials are readily compacted by ramming or rolling. Trautwine gives the weight of Rosendale cement per cubic foot as 60 pounds loose, 70 pounds well shaken and 80 pounds thoroughly shaken.

Mr. A. Black has recently given the percentages of voids in three specimens of sands as 35.0 per cent., 32.3 per cent., and 38.4 per cent. when loose; after being shaken down these were respectively 26.7 per cent., 27.3 per cent., and 31.4 per cent.

A sand cushion 1¾ inches deep is compressed to 1½ inches after rolling, when used as a cushion for a brick pavement.

Rolling the foundation of a pavement, in some soils, will bring more moisture to the surface, by capillary attraction, from depths as great as four feet. The writer has seen a 10-ton steam roller sink so deeply into a clay sub-foundation that it could be moved again only after prolonged work in digging it out. The rolling in this case had the effect of softening the foundation. Usually a compression by rolling, with a weight per inch of run of roller as great as the maximum wheel load the pavement will be called upon to bear, is desirable, but in the case of wet clays a very light rolling or tamping is all that can be done in the way of consolidation.

Supporting Power of Soils.—Prof. Rankine has developed the theory regarding the supporting power of soils, his mathematical deductions have to do with the mutual friction between the grains composing the soil.

"In a mass of earth the active forces," he states, "are the vertical pressures produced by the gravitation of its parts; the passive forces are the pressures conjugate to those vertical pressures whereby the earth is prevented from spreading.

"Earthwork gives way by the slipping or sliding of its parts on each other; and its stability arises from the resistance to the tendency so to slip. In a mass of earth as commonly understood, it arises partly from the friction between the grains, and partly from their mutual adhesion, which latter force is considerable in some kinds of earth, such as clay, particularly when moist. But the adhesion of earth is gradually destroyed by the action of air and moisture, and of the changes of the weather, and especially by alternate frosts and thaw; so that its friction is the only force which can be relied upon to produce permanent stability." "The permanent stability of earth, which is due to friction alone, is sufficient to maintain the side either of an embankment or of a cutting at a uniform slope, whose inclination to the horizon is the 'angle of repose,' or angle whose tangent is the coefficient of friction. This is called the natural slope of the earth."

Sometimes embankments for city streets have to be formed on soft and yielding soils, such, for example, as the salt marsh at Hoboken, N. J., described by Mr. Thomas H. McCann (Trans. Am. Soc. C. E., March 17, 1897). The depth of this marsh was from 30 to 100 feet. "There is little displacement of the meadow at the sides of the fill where the latter is not more than 10 or 12 feet deep, but where it reaches greater depths the meadow is forced up." "First, there is a compression and displacement of the lighter and softer marsh by the heavier filling; second, a shrinkage of the filling material and about the time the road is finished the embankment is floating, so to speak, on the marsh; third, the embankment settles gradually, compressing or displacing (in many cases doing both) the softer marsh. This settlement continues for many years, and, of course, is greatest in a road on which there is a heavy traffic."

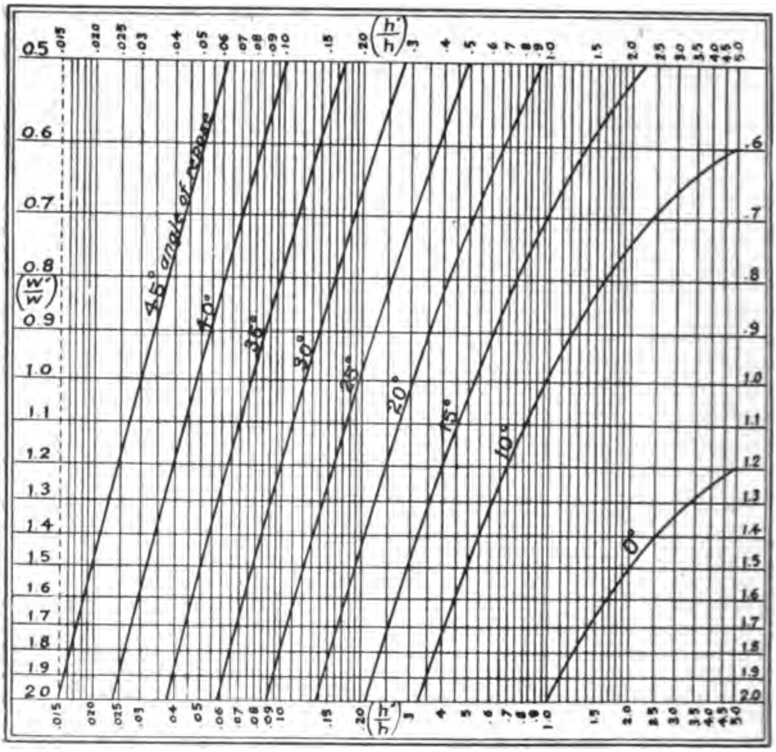
According to Rankine's theory, all embankments may be said to "float upon the natural soil." It is interesting to notice the amount of compression and displacement of the marsh under the embankment, which Mr. McCann has determined by borings and which substantiate Prof. Rankine's theory. The relative weights of natural ground and embankment in the case cited are not known to the writer, but assumed values will be of interest. For example, if the weight per cubic foot of the marsh is assumed as 99 pounds, and that of the embankment as 110 pounds, while the angle of repose of the marsh material is assumed as 15 degrees; Prof. Rankine's formula would indicate that the depth to which the embankment would sink into the marsh would be five-eights of its proposed height above it. This sinking, he suggests, may be counteracted by first digging a trench and filling it with stable material.

Where a city street is to be formed by embankment, made upon ground of almost any nature, and prolonged settlement is undesirable, it would be expedient to dig out a trench for the foundation, in the first place; or at least the material beneath the center of the embankment

	Angle of Repose of Natural Ground.								
$\frac{w'}{w}$	0°	10°	15°	20°	25°	30°	35°	40°	45°
0.5			2.25	0.92	0.49	0.29	0.17	0.10	0.06
.6		4.76	1.36	.67	.38	.23	.14	.09	.05
.7		2.43	0.98	.52	.31	.20	.12	.07	.04
.8		1.63	.76	.43	.26	.16	.10	.06	.04
.9		1.23	.62	.36	.22	.14	.09	.06	.03
1.0		0.98	.53	.32	.20	.12	.08	.05	.03
1.1	10.	.82	.46	.28	.18	.11	.07	.04	.03
1.2	5.	.70	.40	.25	.16	.10	.07	04	.02
1.3	3.33	.62	.36	.23	.14	.09	.06	.04	.02
1.4	2.50	.55	.33	.21	.13	.09	.06	.04	.02
1.5	2.	.49	.30	.19	.12	.08	.05	.03	.02
1.6	1.67	.45	.28	.18	.12	.08	.05	.03	.02
1.7	1.43	.41	.26	.16	.11	.07	04	.03	.02
1.8	1.25	.38	.24	.15	.10	.07	.04	.03	.02
1.9	1.11	.35	.22	.14	.10	.06	.04	.02	.02
2.0	1.	.33	.21	.14	.09	.06	.04	.02	.02

w' = weight per cubic foot of natural ground
w = " " " " " " " embankment.

The table gives values of co-efficient by which height of embankment must be multiplied to find depth of cutting below natural surface, to ensure stability of bank.



Computed from formulas of Rankine's Civil Engineering p.343.

$h' = h . \frac{wk'^2}{w' - wk'^2}$ *where* $k' = \frac{1 - \sin\phi'}{1 + \sin\phi'}$.

ϕ' = *angle of repose of natural ground*

w' = *weight per cubic ft* " " " "

h' = *depth of excav'n into* " " " "

w = *weight per cubic foot of the embankment*

h = *height* " " " "

could be scraped to the sides, to form a portion of the side slopes, without much increase in cost. The writer has computed the accompanying table for convenience of use in this connection, from Prof. Rankine's somewhat involved formulas, to indicate the ratio of depth of trench to height of embankment for various cases. The table, which is given both numi erically and graphically, will be referred to later in another connection.

EMBANKMENTS AND CUTTINGS.—The settlement of an embankment after construction is stated by Prof. Rankine to be seldom less than one-twelfth and seldom more than one-fifth of the original height. Prof. M.

Sapper, of Hanover, suggests that the settling of embankments should be neutralized by increasing both their heights and widths as follows:

Nature of Embankment.	Extra Height.	Upper Widening.
Loamy, clay ground......	1/12 h.	1/8 h.
Mould, black earth........	1/14 h.	1/9 h.
Sandy soil	1/23 h.	1/15 h.
Gravel dump	1/30 h.	1/25 h.
Stone dump	1/40 h.	1/40 h.

"h" represents the height of the embankment on level ground, in inclined ground the value of "h" is equal to the height of the top of the bank above the lowest edge of the down-hill slope.

Both the English and the American practice is to assume that soil removed from cuttings will not measure as much in a settled bank as it did in the original cutting. Mr. P. J. Flynn has discussed this matter in an interesting paper before the Technical Society of the Pacific Coast, June 5, 1885 (given in Eng. News, May 8, 1886). He comments as follows:

"The disagreement of the German authors from the American and English practice as to shrinkage is certainly remarkable. The Germans give on the whole, a permanent *increase* for sands, clays, and similar materials; but on the contrary the Americans and English give a *diminution.*" Prof. Baker, in his admirable treatise on "Roads and Pavements," summarizes the reasons for the shrinkage of earth embankments as follows:

"(1.) The continued action of frost has made the soil in its natural position more or less porous.

(2.) Earths which have been lying in situ for centuries become more or less porous through the slow solution of their soluble constituents by percolating water.

(3.) The surface soil is rendered more or less porous by the penetration of vegetable roots which subsequently decay.

(4.) There is ordinarily more or less soil lost or wasted in transporting it from the excavation to the embankment."

It appears to the writer that a fifth and very important cause of shrinkage arises from the change in water content of the soil. In an embankment, drainage and evaporation can reasonably be assumed to deprive the soil of much of the moisture it contained while in its original bed. The deprivation of moisture will cause more shrinkage in clay than any practicable consolidation by mechanical means. The writer made the following experiment regarding this shrinkage. A section of undisturbed clay was removed from a depth of four feet below the surface of a sidewalk, in the City of Albany. and was carefully trimmed to dimensions, without disturbance of the natural layers. The clay was good brick-clay and contained apparently less moisture than at lower depths. It was found to weigh 119 pounds per cubic foot. It was exposed to natural summer atmosphere in August, in a shaded place, the humidity of the air being from 40 per cent. to 70 per cent. Pins were placed in the clay and measurements made between them from time to time, at the end of two days the clay had divided into two parts along a plane of stratification about in its center, but no other cracks of any magnitude appeared during the progress of the experiment. Its loss of weight was then 12 per cent. of the original weight and the distance between the pins had contracted by 6.3 per cent.

After six days' drying, the clay, which at that time appeared quite dry and hard, was again carefully measured and weighed. It had then shrunk to 86.9 per cent. of its original volume, and weighed 105 pounds per cubic foot, the distance between the pins had shortened by 7¼ per cent., and the weight had diminished by 23 per cent. of its original amount. The water in the pores of the clay still continued to evaporate, however, and at the end of two weeks the entire loss was 28 per cent. of the original weight. This compact clay therefore contained about 38.8 per cent. of its dry weight of water. Although it was when first dug out, packed much more firmly than any ordinary consolidation by mechanical means could have effected, nevertheless it was capable of a shrinkage in volume of over 13 per cent. by evaporation alone.

This experiment indicates that in clay soils, and possibly in others, the loss of water by drainage and evaporation may account for much shrinkage and settlement. It has been observed that a brick from a stiff-mud machine will shrink from 5.7 to 10 per cent. in its linear dimensions on leaving the drier. (Tr. Am. Soc. C. E., Vol. 29, p. 664.)

Mr. Eliot C. Clarke instances a case in connection with the main drainage works of Boston where a deep trench "drained the water out of the adjacent soil, rendering it spongy and somewhat compressible, so that the whole street settled and had to be resurfaced and repaved."

Referring again to the table computed from Prof. Rankine's formulas, it is seen that just as a ship sinks a certain distance into the water before it is held in equilibrium (the angle of repose of the water being zero) so an embankment may be found to sink into the natural soil and thus appear to shrink and occupy less volume than when its material was removed from its original position. Even with an angle of repose of 30 degrees and with natural soil of the same density as that of the embankment, the table indicates that ultimate stability will only be attained when a settlement—or apparent shrinkage—of 12 per cent. has occurred. This settlement may be extremely slow and the embankment may for years be in an unstable condition, for the angle of repose is a somewhat uncertain and variable quantity and will be affected also by changes of water content in the interstices of the soil. It is not maintained by the writer that a subsidence as great as the tabular amounts may be expected under every embankment, the compression of the soil by the weight of the embankment may soon increase its density and thus retard further settlement, still it is reasonable to suppose that part of the assumed shrinkage of earthwork may be due to an actual subsidence into the underlying natural soil. The whole matter of the shrinkage of earthwork does not seem to have been investigated very scientifically. To this end the amount of water contained in the soil before removal from the cutting and the weight of the soil per cubic foot both in its natural condition and after drying completely, without disturbance, should be ascertained and the same data should be secured from the embankment at various depths and at different lengths of time, while careful notes should be made as to the physical character of the soil, the amount of rainfall and the method of depositing the earth in the embankment. Borings or test pits should also be made to show the amount of subsidence of the embankment into the natural soil.

It does not seem that the method of tipping the earth or of consolidating the earthwork would materially affect the ultimate amount of shrinkage, although a much greater time might have to elapse with imperfect initial packing of the earth than if greater care had been taken with this. Hewson, in his work on levees, says: "Sand, however loosely it may be shovelled together fills its space closely; and therefore whether wet or dry, settles at a very small diminution of the original bulk. In time, too, the process of the settlement is short."

Regarding clay embankments, on the other hand, Spons Dictionary of Engineering states that settlement may in some cases continue for ten years. In those portions of the City of Albany where the subsoil is a dense, wet clay, precautions sometimes are taken to maintain the moisture at its normal amount. Under certain buildings this has been secured by irrigating the foundation. Trees are occasionally cut down when their roots are thought to have too great an effect upon the drying of the soil. This drying effect is much greater than is often supposed and city trees should be provided with means of obtaining a sufficiency of water. Prof. King shows that a growing crop of corn will use from 200 to 300 pounds of water per pound of dry material produced.

Where streets are covered with a water-tight pavement, the entire street surface in some cases seems to settle slowly for many years in a manner that it is difficult to account for except by a slow drying out of the water contents of the clayey subsoil. In this case a renewal of the pavement with a re-surfacing of the original concrete base should effect a permanent improvement.

Under a water-tight pavement there is probably at first a certain loss of water by downward percolation, until a condition of equilibrium is reached when capillary attraction thereafter maintains a nearly fixed amount of water drawn from the underlying ground-water. The writer has investigated the actual changes in level of Center Market in Albany.

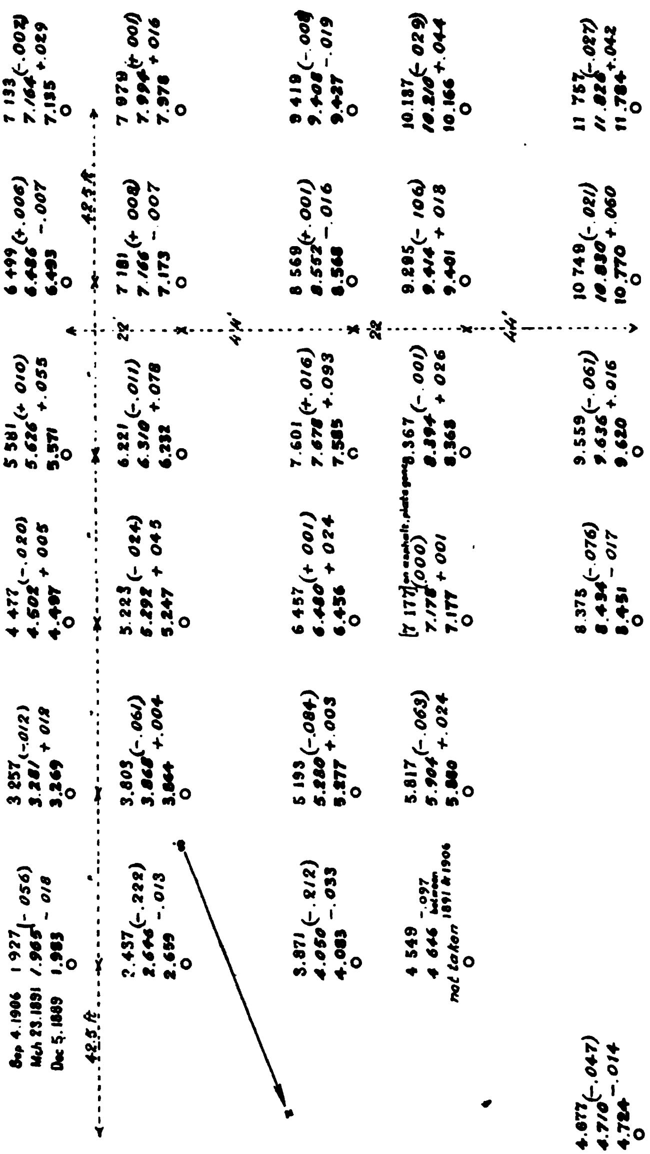
The site of this market comprising 7,461 square yards of asphalt pavement, was covered with buildings and by the adjacent sidewalks. The buildings were removed in 1888 and the site was graded in December of that year, there being no filling except in the cellars of the houses. A sheet asphalt pavement on a six-inch concrete base was laid in the summer of 1889. Numerous brass caps were placed in the asphalt, with their bases resting on the concrete, at intervals of about 44 feet. The levels of these were determined in December, 1889. over about 3,000 square yards of the area. The levels were repeated in March, 1891, 15 months after the first and while there was frost in the ground. Nineteen of the brass caps were found to have risen 0.031 feet on an average, while 9 had sunk 0.016 feet on an average. The greatest rise was 0.078 feet and the greatest settlement was 0.033 feet. The levels were repeated September, 1906, 16 years 9 months after the first levels, the asphalt having remained undisturbed meanwhile, but in daily use. Twenty-one of the caps were then found to have sunk from 0.002 feet to 0.222 feet, the average settlement of 0.059 feet being partly attributable to slight wear of the brass caps.

The remaining seven caps were from 0.001 feet to 0.016 feet higher than originally observed and it would appear with these as if the heaving observed in March, 1891, had never been entirely overcome by subsequent settlement. These levels are diagrammatically shown on next page.

CONSOLIDATION.—Consolidation of undisturbed soil is best effected by rolling with as heavy a roller as the nature of the soil will permit. Where, as has already been pointed out in the case of clay subsoil, a light roller must be used, it should be passed over the surface a greater number of times than would otherwise be necessary and the roller should be used transversely, as far as this may be practicable, as well as longitudinally. Where a roller can not be used, for lack of room, tamping by hand must be resorted to. This is very laborious work and is frequently slighted. Large embankments are sometimes consolidated by rollers. but generally their use in this connection is restricted to embankments for retaining water. Where a city street is to be formed in embankment and it is desirable that the ultimate settlement should be secured without long waiting the use of rollers, especially the so-called grooved rollers may be quite desirable. The most vexatious irregularities in city streets are caused by the cutting of trenches without sufficient effort to obtain, or indeed where it may be nearly impossible to secure the ultimate settlement before the pavement is laid. Where the ground is quite pervious to moisture and it is well under drained, a very liberal use of water will cause grains of sand and gravel of different size to pack closely and the surplus water will drain off, thus effecting a very compact and unshrinking filling.

With retentive and wet soil and clay back-filling the use of water will most certainly be followed by slow settlement which may continue for many years with disastrous effect upon street pavements or sidewalks.

Where a cut must be made in an existing pavement and the soil on the sides of the trench is retentive to moisture, dry granular material should be used for the back-filling. This filling need not be of an expensive nature, steam-ashes, or rubbish such as broken bricks and mor-



Levels on brass caps in asphalt. Center Market, Albany, N.Y.
In each instance, the 1889 heights are the bottom numbers, those of 1891 next, and 1906 on top. Differences between 1889 & 1891 are given and, in brackets, between 1889 & 1906.

tar from the removal of old buildings—called "hard-core" in England—will answer the purpose well. Very careful and thorough pounding is essential, if clay and loam are used for back-filling, and even then it will be found quite impossible to pack lumps of clay without leaving large voids, even if the rammer has a small cross section. This latter requirement is essential if clods of clay are to be broken; a light rammer also will be more efficient in securing good work than a heavy one which will soon exhaust the laborer. The writer believes that back-filling of trenches where no subsequent settlement is to take place can only be secured, in many soils, by the use of other power than human muscles for the tamping. A given expenditure of money should secure better results through tamping with compressed air, steam, or other similar source of power than where human muscular effort is relied on.

Earth filling is said to have been very perfectly consolidated by the feet of goats in the formation of puddled walls for reservoirs, but in city streets such means of tamping loose material would seem to be impracticable.

In contract work involving the back filling of trenches, the writer secured great improvement in the pounding of the filling by making the number of days labor for this end one of the items in the approximate quantities and by inserting the following clauses in the specifications:

"Back-filling of Trenches.—All back-filling is to be well and thoroughly pounded in thin layers. The number of men back-filling is never to exceed that of the men pounding. The contractor is to be responsible for all settlement over the lines of trench, and to take up and relay the concrete and pavement if such settlement causes perceptible hollows in the pavement during the five years period of guarantee. Water tamping is not at any time to be used except in porous and gravelly soil. Wet clay is not in any case to be used for back-filling. Frozen material is in no case to be used for back-filling.

Price Paid for Labor.—For labor actually performed upon the work of pounding the material filled into trenches, the contractor will be paid in accordance with his price bid for each day's labor. The amount of such labor is to be verified by the inspector and is to be expressed in days and hours."

The object sought was to secure from the contractor work on the pounding with no pecuniary loss to him. From motives of expediency it was found that the contractor invariably made his bid at the prevailing rate of wages.

Miscellaneous Trenches.—In case a pavement is under guarantee of maintenance for a term of years it has been the practice of the writer to provide that the contractor shall do all the back-filling of trenches where cuts are made in his pavement during the period of guarantee, in accordance with the following specification:

"Price to Be Paid for Repairs to Cuttings.—All back-filling to be of selected dry material, acceptable to the city engineer, and thoroughly tamped in place in thin layers, to be furnished and tamped at the rate of 75 cents per cubic yard for the first ten cubic yards, and at the rate of 60 cents per cubic yard for each yard over the first ten cubic yards. The above prices to include the removal of the old material excavated. In case the old material excavated is, in the opinion of the city engineer, suitable for back-filling, it must be so used and one-third the prices named above for new material will be paid for the tamping and consolidation of such old material."

Other clauses provide for the repaving over cuts, and for the terms of payment for this, also that the contractor's guarantee of maintenance shall apply to all such repairs as well as to his original work.

In the miscellaneous cuttings in paved streets, it would seem proper, and indeed quite essential, if prolonged settlement is to be avoided, that the work of back-filling should be done entirely by the laborers of the city, under competent supervision. The regulations of the City of Washington seem admirably designed to secure good work in this respect. The back-filling and repairing are done by the city at fixed prices, which are charged against those to whom permits are issued. Deposits from all plumbers are required and when the charges against any plumber are found to be exhausting or depleting his deposit he is required to make good the deficiency or to have all future permits for cuts withheld.

Most of the evidence available indicates that it is very difficult but not impossible, to replace all of the old material excavated, where the tamping depends upon the muscular efforts of laborers. With small excavations as, for example, post holes, the laborer retains sufficient energy to replace all the material excavated notwithstanding the comparatively large volume occupied by the post.

With trenches for laying pipes, the space actually required for a sewer or water pipe should be taken into consideration. The writer has devised the following convenient rule for ascertaining the displacement due to sewer pipe: "The number of cubic yards displaced by 100 feet of pipe is equal to 0.03 of the square of the pipe's inside diameter in inches." The rule assumes the pipe to be laid in two foot lengths and under that supposition makes allowance for the hubs. For example, a 10-inch pipe is found to displace 3 cubic yards per 100 feet by the above rule, more exactly this should be 2.94 cubic yards, while a 30-inch pipe displaces 27 cubic yards, the rule being quite precise for this and other large sizes of pipe.

Mr. E. W. Hammatt gives for displacement of water pipe (Eng. News, April 7, 1898):

6 inch	0.27 cub. ft. per ft.	1.00 cub. yds. per 100 ft.
8	0.44	1.63
10	0.69	2.56
12	0.96	3.55
14	1.29	4.78
16	1.66	6.15

The article referred to contains many useful practical remarks as to the back-filling of trenches.

PROVISION FOR PROTRACTED SETTLEMENT.—Even with faithful work it seems nearly impossible to avoid some settlement in clayey back-filling, and as the subsidence will continue for several years, it may be expedient in some cases, as for example with deep filling within retaining walls at bridge approaches, to provide temporary pavements and sidewalks, with the intention of replacing these with more permanent ones in the future.

As stated in a "Special Consular Report on Streets and Highways in Foreign Countries" in 1891, the City of Frankfort-on-the-Main, having a soil which "forms an uncertain and treacherous foundation for pavements, especially when the original earth has been previously disturbed by the laying of sewers or water mains," makes a practice of laying temporary stone block pavements and "after some years of use have thoroughly settled and solidified the ground to take up the temporary pavement" and relay a permanent pavement in its place.

Although this procedure seems an open acknowledgment of defeat in the conflict, still it may be the part of wisdom and expediency to allow the forces of nature to do their worst in the matter of earth settlement and afterwards to found pavements and sidewalks upon the thoroughly established surface.

Time, indeed, is the potent factor in securing stability, but a careful study of the peculiarities of the soil, with vigilant inspection and a very liberal expenditure of energy in consolidating the filling, may in a great measure supplant the necessity of long waiting for ultimate settlement.

THE PRESIDENT: We want to get the report of the Committee on Exhibits in, and it seems to be necessary to get it in just at this time. I will ask Mr. Davis to present it.

REPORT OF THE COMMITTEE ON EXHIBITS.

The Committee on Exhibits desires to report as follows: That owing to certain delays the actual work of the exhibit portion of the convention was not started until about August 10. Your committee found it impossible to secure the desired number of exhibitors in so short a time, as the freight rate, distance for shipping exhibits were also against them in their work. But your committee feels that all municipal supply people exhibiting this year are well pleased, and recommend that the Exhibit Committee be continued as one of the committees of the Society, feeling assured that at the next convention held in the City of Detroit, the exhibit portion of the convention will be one that will attract great interest to all concerned.

The committee wishes to further report that they have secured a number of new associate members whose names and dues have been reported to the Secretary.

ROBT. K. DAVIS, *Chairman.*

MR. DAVIS: I would further like to make the report to the convention on behalf of our committee. Great praise is due in this work to Mr. Julian Kendrick, of Birmingham, and as chairman of that committee I want to take this opportunity to thank every one of the corporate members who were on the Exhibit Committee with me, for the efforts and the support they gave me in that work, as an associate member of the Society. I have other work to do in regard to closing the exhibits, and I have to get away, and that is the reason I wish to make the report at this time.

THE PRESIDENT: You have heard the report. If there is no objection it will be accepted and filed.

MR. FOLWELL: The amount of work could hardly be measured by the exhibits themselves, for I happen to know that Mr. Davis and Mr. Kendrick have done a great deal of work in getting up the exhibits. I move that the thanks of the Society be extended these gentlemen for their efforts.

THE SECRETARY: In seconding that motion, I want to reiterate what Mr. Folwell has said, and add to it by making it still stronger by saying that if it had not been for Mr. Davis there would have been no exhibit this year. Owing to unforseen circumstances it was necessary for the original chairman to resign, and as the members of this Society very seldom see each other, except at these meetings, it was extremely difficult to start anything at all, and what was done was done very late, and I know that had it not been for Mr. Davis' efforts, and had they not been unusual of themselves, we would have had no exhibits.

MR. KENDRICK: I want to say that Mr. Davis should not have thanked me for what I did, for as a matter of fact I would not have done anything if he had not made me do it.

THE PRESIDENT: As President of the Society, I want to add my word to the exhibits. My connection with the committee has been largely in preparing and submitting the program for publication and I want to say that Mr. Davis has shown the greatest energy in getting the matter through, and I want to say that I was very much surprised that he was able to do it in the short time at his command. I am sure he will have something at Detroit next year well worth having. The report is accepted and placed on file.

Mr. Folwell: Should there not be a motion that this committee be continued another year?

The President: The adoption of the report carries that. The papers are now ready for discussion if you are not too hungry. It is a quarter past one.

Mr. Reimer: Mr. Chairman, sometimes we lose members by the fact that they don't renew their dues, some will go away, and others come, but seldom in this Association has one been lost through death. I would like to offer this resolution:

Whereas, It has pleased an All Wise Providence to remove from us one who was once our President and an enthusiastic member of this Society, who was an energetic and faithful municipal officer and a man honored by his home city by continuing him in its service for many years; therefore, be it

Resolved, That this Society express its sorrow at the loss by death of Mr. George M. Ballard, late of the City of Newark, N. J., and that our sympathy be conveyed to the family of the deceased by sending to the same a copy of this resolution, and that this preamble and resolution be spread upon the minutes of this Society.

The President: You have heard the resolution; if there are no remarks, those in favor of the resolution will please rise.

(Resolution was adopted by unanimous vote.)

The President: We have an election of members to take place at this time, and I will ask the Secretary to read the list.

CORPORATE MEMBERS.

Prof. Edward B. Kay, Tuscaloosa, Ala.
E. L. Dalton, City Engineer, Dallas, Tex.
Geo. P. Codd, Mayor Detroit, Mich.
P. W. Henry, Consulting Engineer, 17 Battery Place, N. Y.
F. E. Murphy, Supt. Streets and Water Works, Huntsville, Ala.
J. L. Ludlow, Consulting Engineer, Winston-Salem, N. C.
Wright Smith, Chief Engineer Board of Public Works, Mobile, Ala.

W. M. Wilson, City Engineer, Gadsden, Ala.
Francis H. Wright, City Engineer, Helena, Ark.
C. E. Leonard, City Engineer, Austin, Tex.
Nisbet Wingfield, City Engineer and Com. Pub. Works, Augusta, Ga.
Wm. Solotaroff, Supt. Shade Tree Com., East Orange, N. J.
Geo. S. Watson, Consulting Engineer, 54 Baxter Bldg., Philadelphia, Pa.
R. H. McCormick, City Engineer, Detroit, Mich.
Allen R. Gilchrist, City Engineer, Montgomery, Ala.
J. K. Mitchell, General Assistant Engineer, Detroit, Mich.
Wm. J. Parkes, City Engineer, Pine Bluff, Ark.
Wm. F. Day, Engineer in charge of Sewers, Detroit, Mich.
Edward B. Codwise, City Engineer, Kingston, N. Y.
R. W. Ball, City Engineer, Henderson, Ky.
Allan W. Dow, Consulting Chemist, 120 E. 23d St., N. Y.
Frank A. Hinds, Consulting Engineer, Watertown, N. Y.
Geo. G. Earle, General Supt. Sewerage and Water Board, New Orleans.
L. H. Weissleder, Consulting Engineer, Cincinnati O.
W. H. Gainey, City Engineer, Valdosta, Ga.
John M. Monie, Municipal Engineer, Bonne Terre, Mo.
Geo. W. Fuller, Consulting Engineer, 170 Broadway, New York.
R. E. Meade, Consulting Eng, 1520 Brown-Marx Bldg., Birmingham, Ala.
Frank J. Bock, Commissioner of Public Works, Newark, N. J.
Arthur R. Denman, Commissioner of Public Works, Newark, N. J.

ASSOCIATE MEMBERS.

A. L. Barber Asphalt Co., 17 Battery Place, New York City.
Barrett Manufacturing Co., 17 Battery Place, New York City.
Clements, L. L., U. S. Wood Preserving Co., Mercantile Library Bldg., Cincinnati, O.
Davis, Robert K., Hammond Building, Detroit, Mich.
Donaldson, John, Southern Bitulithic Paving Co., Birmingham, Ala.
Engsfeld, G. C., Southern Paving & Construction Co., Birmingham, Ala.
Hutchinson, F. S., 17 Battery Place, New York City.
Lasley, T. H., Vice-Pres. Southern Clay Manfg. Co., Chattanooga, Tenn.
Lasley, W. M., Pres. Southern Clay Manfg. Co., Chattanooga, Tenn.
Mead, A. J., Reinforced Concrete Pipe Co., Jackson, Mich.
Parker, R. H., Southern Clay Manfg. Co., Chattanooga, Tenn.
Reinforced Concrete Pipe Co., Jackson, Mich.
Rock, J. C., 17 Battery Place, New York City.
Southern Cement Co., Birmingham, Ala.
Tenney, Geo. O., Pres. Atlantic Bitulithic Paving Co., Spartanburg, N. C.
Warren, Ralph, 93 Federal St., Boston, Mass.
White, W. W., Reinforced Concrete Pipe Co., Jackson, Mich.
Wilson, John A., 902 First National Bank Bldg., Nashville, Tenn.

THE PRESIDENT: You have heard the list, shall they be elected?

Mr. Sherrerd: I move that the Secretary cast the vote of the Association for the election of the members.

Motion seconded and was carried.

The President: We have now the report of the Committee on Resolutions, which will be presented now by Mr. Hatton, the chairman.

Whereas, His Honor, the Mayor and Board of Aldermen of the City of Birmingham have so kindly and courteously placed the city hall at the disposal of the Society as a place for holding its Annual Convention, and have extended to its members an open house with the key in our possession, and have shown the members of the Society, both individually and collectively, the most unbounded hospitality; and,

Whereas, The Birmingham Water Works Company entertained the Society by showing its members the extensive, interesting and well kept plant of the said company, and threw in as a very much appreciated side issue an old-fashioned southern barbacue, which was partaken of with great pleasure by the Society; and,

Whereas, The Louisville & Nashville Railroad Company entertained the Society most instructively by carrying its members, by special train, through the coal and iron industries of the Birmingham district; and,

Whereas, The Birmingham Railway, Light and Power Company extended the freedom of its railway service to the members of the Society during its convention; and,

Whereas, The Birmingham Athletic Club kindly extended the privileges of its very beautiful club house and appurtenances to the Society; and,

Whereas, The citizens of Birmingham, through the Commercial Club, have extended the greatest hospitality to the Society, throwing in a beautiful drive over the mountains to the waterworks station, a bountiful and continuous luncheon during the railroad trip around the horn, and in many other ways thus making our visit to the City of Birmingham one long to be remembered by every member of the Society whose privilege it has been to attend this annual convention and who will carry home with him a much broader idea of the present magnitude of the industries of the city and of its great future importance to this republic, which city, however, is no bigger than the hearts of its people;

Now, Therefore, Be it Resolved by the American Society of Municipal Improvements that its heartfelt thanks be extended to his Honor, the Mayor and Board of Aldermen; to the Birmingham Waterworks Company; to the Louisville & Nashville Railroad Company; to the Birmingham Railway, Light and Power Company; to the Birmingham Athletic Club; to the citizens of Birmingham through its Commercial Club, and particularly to Birmingham's most efficient city engineer, Mr. Julian Kendrick, for the courteous and extreme hospitality thus extended to this Society, which have been the principal means of making this convention one of the most profitable ever held; and,

Be it Further Resolved, That the Society appreciates the earnest efforts of Mr. R. K. Davis, chairman of the Exhibit Committee, and the several exhibitors who have so kindly placed their exhibits in the exhibition hall for the benefit of the members of this Society, which display has been very interesting and instructive to the several visiting members, and it is hoped that this feature of the annual convention may be continued and enlarged upon in the future to the advantage of both the members of the Society and to the exhibitors.

The Society further extends its appreciation to the press of Birmingham for the liberal space which has been daily given to the Society's proceedings. (Signed)

T. CHALKLY HATTON,
FRED GIDDINGS,
J. S. VINSON,
Committee on Resolutions.

MR. HATTON: Mr. President, in furnishing this report I wish to add just a little paragraph to that resolution, and that is with respect to Mr. Julian Kendrick's kindness to the Society. The committee felt that they did not want to put too much in there, knowing Mr. Kendrick's unusual bashfulness, and feeling that if we did say too much, it would scare him from going to the Detroit convention, but every member of this convention has appreciated Mr. Kendrick's untiring efforts for our pleasure, in showing us everything about the town, and his social as well as personal courtesy, without which we would not have had half as much pleasure in this convention as we have had. (Applause.)

THE PRESIDENT: You have heard the report, what shall be done with it?

MR. OWEN: I second the adoption of that report. Even, gentlemen, they so far favored us, that when we Northern people came down here they gave us the cold weather like we are used to to prevent what they call the Southern tired feeling. I don't think we have had any tired feeling, and while I say that, I want to express my keen appreciation at the magnitude and growth of the City of Birmingham. There is no Southern tired feeling here, and when I recall the time far back when I visited this city, when real estate was down, and look at the development of this city in the last few years, it seems to be a marvel to the United States, and in saying that I want to pay my tribute to the City of Birmingham. (Applause.)

THE PRESIDENT: Any further remarks. If not, those in favor of the motion will please rise.

(Motion unanimously adopted by rising vote.)

THE PRESIDENT: Now, gentlemen, it comes time to close the convention, and I want to say just a word or two in retiring from the office. I want to thank the chairmen of the various committees for the splendid work they have done in preparing the program and also the members of most of the committees who have done their share and the members of the Society who have come forward on the request for the papers on the program, and I desire to thank the members of the board and the members of the Society generally for the support they have given me. Our new President is a man of very much courage and he is going to show his energy at the very beginning and I am sure that you will have a very prosperous year under him. If you will support him as manfully as you have me, I am very sure of it. I very heartily welcome him to the chair which I vacate. (Applause.)

MR. SHERRERD: Mr. President and members of the American Society of Municipal Improvements. Before making announcement of the committees, which I think it would be wise to announce at this early time, in order that the work for next year's convention may be taken up at once, I wish to thank the Society for the honor which it has done me in my selection as your presiding officer. I have had the interest of this Society at heart for the ten or eleven years I have been a member, and during that time have only missed one meeting, the Milwaukee convention. I want to ask in assuming the duties of this office that I may have the cordial support of the members of the Society, and particularly do I think that each one can aid by trying to interest the people in the municipalities in their immediate vicinities to join this Society. At Detroit, Mich., I think that we will be able to materially increase our membership, and knowing as I do the value of the papers that have been presented to this Society, and the good it has done those who have attended this meeting, I believe we ought to show to our brother engineers and those interested in municipal matters the advantages of joining the Society, and I believe with due effort we can have a rousing meeting in Detroit. I would take this opportunity to announce the tentative suggestion of the membership of the committees.

(Here the President read a partial list of the committees.)

PRESIDENT: Is there any further business before the Association?

MR. OWEN: I would like to move a vote of thanks to our retiring President, Mr. Brown, for his energy and industry in the management of this Society during the last year. It will make him appreciate somewhat the work he has done.

Motion received a second and carried.

THE PRESIDENT: Before declaring the convention adjourned, I would like to say that in my experience in these kinds of gatherings, the work of the Society devolves almost entirely during the interim on the Secretary, and I accept this naturally from your hands feeling that with the efforts the Secretary has always given the Society, its work will progress in the same ratio in the future as it has in the past. (Applause.)

MR. HATTON: Mr. President, it is not necessary to give a vote of thanks to the Secretary, for everybody who has been connected with the Society knows of the good work he has done, and it would be out of order.

MR. REIMER: I move that we adjourn.

THE PRESIDENT: I make the announcement that the Executive Committee have considered the time for holding the next convention, and have decided that it would be advisable to advance the date slightly from the date fixed in the constitution, and we would

therefore announce that we have fixed the third Tuesday in September as the date for holding the next annual convention. If there is no other business, I will declare the convention adjourned until said date.

EXHIBITION

The exhibiton by the associate members was held on the same floor of the City Hall as the Convention. The room was decorated very tastefully, and the exhibits were all good. This exhibition is getting to be one of the features of the Society's meeting, and it is to be hoped it will be more largely attended in the future. The exhibitors and exhibits were as follows:

The Bitulithic Pavement, paving materials, sections of pavements, photographs of work, samples of Puritan sanitary flooring and of their slushing compounds.

A. L. Barber Asphalt Company, samples of Bermudez asphalt and photographs.

The Birmingham City Laboratory, biological exhibit, cultures, etc.

The Reinforced Concrete Pipe Company, samples of 30-inch pipe and photographs.

The Municipal Journal and Engineer.

Graves Shale Paving Brick Company, of Birmingham, samples of brick and shale.

American Wood Preserving Company, wood paving blocks.

The Barrett Manufacturing Company, tarvia and photographs of tarviated roads.

The Thompson Meter Company, assortment of water meters.

The Southern Clay Manufacturing Company, paving brick and blocks, and photographs.

The Southern Cement Company, samples of "Alabama Portland" and "Magnolia" slag cement.

The Southern Sewer Pipe Company, pipes and other clay products.

APPENDIX

THE WATER WORKS OF ARCHANGEL, RUSSIA.

BY U. TOWBENHEIM, MANAGER, CITY WATER WORKS.

We hardly find any data at all in American literature concerning water supply in Russia, and it therefore seems to me that a description of the water works, constructed at Archangel, in the far North, may be of some interest.

The specialist will find sundry shortcomings in this plant from a technical point of view, but it must be borne in mind that this water supply was constructed with the object of satisfying the altogether exceptional local condition with a minimum of capital. The consequence of this last condition being, as might be expected, a minimum of success.

The construction was commenced by the writer in the spring of the year 1902, and completed in May, 1903.

GEOGRAPHICAL POSITION AND CLIMATE.

Archangel is situated in 64° 33′ north latitude and 40° 32′ east longitude on the right shore of the Northern Dwina, at a distance of twenty-six English miles from its outlet into the White Sea, and has a population of 21,000 inhabitants. Of this number 13,000 live in the town and 8,000 on a suburban island called Solombola.

The elevation above mean water level varies from 14 to 20 feet. The marshy ground on which the town is built is locally called "tundra," and reaches a depth of about 21 feet, clay following lower down.

The town being situated within two degrees of the polar circle, the climate is severe, being at the same time subject to great contrasts. The average yearly temperature equals .3°C (32.5°F.), with a maximum of 34.4°C (93.9°F.), and a minimum of —47.5°C (—53.5°F.). These readings are based on observations extending over the last 20 years. The river is covered with ice from October until the end of April.

The mean annual precipitation is on an average about 16 inches.

The length of the day in June is 21 hours, and in December 4 hours.

LOCAL CONDITIONS WITH REFERENCE TO WATER SUPPLY.

The town contains a total of 1,150 buildings of from one to two stories, and they are situated on an area of 3.125 x .5 miles, *i. e.,* 1.56 square miles. It practically consists of one long street, an arrangement rather advantageous with regard to fires.

There are hardly any industrial concerns in the town itself. All the mills are built farther down the river, on separate islands which are of no interest to us, since they are not included in the region of the action of the water supply.

Owing to the absence of a sewerage system, the consumption of water is surprisingly insignificant; even the number of water closets and bath rooms is limited, in view of its being necessary to direct the waste into cesspools, from whence it is carted away in the most primitive manner.

The type of closet in general use consists of a seat, made of several boards, nailed together in some cold passage or shed and connected by means of a straight wooden pipe, with the cesspool located under the floor. This system is even used in connection with two-story houses. Only in the end of last year water closets and bath tubs were put up in the local hospital. The care of matters hygienic is intrusted to the frost.

The arrangement of house water supply usually consists of a tap placed in the kitchen, and that is all. The kitchen slops are carried out in pails to a cesspool, located in the yard not far from the house.

There are two public bath houses in the town, of which one is supplied with water from the water supply. The other one is fed with water directly from the river and the suction pipe is laid so skillfully that it often becomes choked with sand and slime. A third bath house, which took water directly from the swamp, ended its existence recently.

Linen is rinsed in the river; in winter holes are made in the ice for this purpose, and kept clear by special attendants who get a certain payment from each family.

Watering the streets is almost unnecessary during the short summer time, as the ground is sufficiently moist without it. The outlying streets tail off into the marsh, where a horse may easily be drowned within a few yards of the houses.

When the foregoing facts are taken into consideration the exceedingly small average daily consumption of water, *i. e.*, 6½ U. S. gallons per inhabitant, becomes easily comprehensible.

There is little need for taking the future density of the population into account, as its growth, amounting to 112 inhabitants per annum (*i. e.*, 701 births to 589 deaths) is insignificant; and if 38 per cent. be deducted on account of the industrial region, which, as has been stated above, is not supplied with water and to which it is not even proposed to extend the water supply in future, the growth of the population will in reality come to only 70 people per annum.

The population is not appreciably increased by the arrival of newcomers, since local trade and industry are at zero.

Political exiles form only a temporary element of the population and the insignificant consumption of water by them may be ignored.

We have favorable conditions for laying the pipes. The soil is moist and marshy and this fact was taken into consideration in determining the depth at which the pipes should be laid. In the winter time an icy covering is formed, reaching a maximum thickness of 5 feet, the soil below this depth not being affected by the frost. The pipes are therefore laid at a depth of 7 feet 6 inches. During the summer all the frozen soil thaws, so that the frost has no time to reach a greater depth. There are only inconsiderable strips of ground situated in the outskirts of the town, near the shore, at both ends of our district, where the layers of clay reach the surface of the ground; here the soil freezes down to 9 feet 3 inches deep and the pipes are laid at a depth of 12 feet 10 inches.

During the three years of the existence of the water supply there has not been a single case of freezing of the mains.

With the arrangement of a sewerage system the level of ground water would become lower, in view of which fact the soil would freeze deeper than under the present conditions, but it may be stated with certainty that there is no hope for the arrangement of a sewerage system even in the distant future.

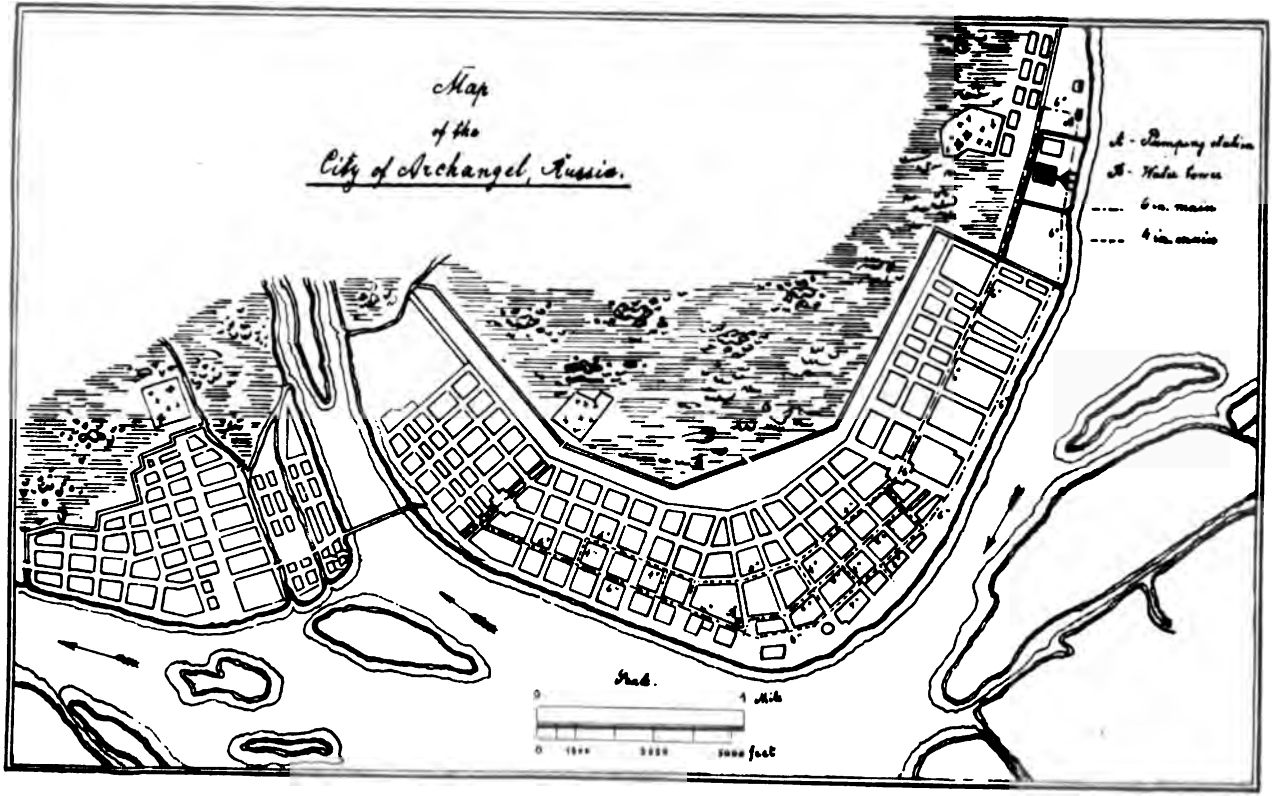
Surface drainage was arranged in sundry places about 10 or 15 years ago, but it was made with incorrect inclines and therefore serves more to collect water than to dry the locality.

The waterworks are owned by the town and the income does not even cover half the expenses. This is due to the fact that water is furnished to the consumers unmetered, and that up to 20 per cent. of the daily pumpage has to be given free of charge. The latter right is enjoyed, according to law, by all soldiers and gendarmes, commencing with the officers and ending with the lowest ranks, inclusive; besides this, water must be supplied gratis to many schools, charitable institutions and hospitals. During the three years of the existence of the water supply, not a single cent has come in for the use of water from the Governor. No payment is made by insurance companies for the insertion of fire hydrants.

ARRANGEMENT OF WATER SUPPLY IN HOUSES.

Most of the houses are built of wood and the floor of the bottom story is situated at a distance of from 2 to 6 feet from the ground. The space below the floor is generally not occupied by anything and therefore warm basements are a rarity. The pipes are laid in the following manner: a branch, taken from the street line, is placed under the foundation of the building on a level with the existing mains and is brought up through the basement space at a distance of 2 feet from the exterior wall. A wooden casing of not less than 3.5x3.5 feet cross-section is placed round this part of the pipe. This box is filled with manure mixed with hay, and covered with a thin layer of lime and the last foot under the floor is filled with ashes. All this is covered by a detachable hatch, so that in case the isolating materials should settle, an additional supply of the same may be put in.

As it is difficult to get to the curb cock in winter, owing to the depth of snow, a second stop cock is placed at the entrance of the pipe into the room.


Map
of the
City of Archangel, Russia.
A - Pumping station
B - Water tower
6 in. main
4 in. main
Scale.
0
1 Mile
0
1000
3000
5000 feet

Every house has sundry outbuildings in its yard, to which, from motives of economy, water pipes are not usually led, but an outlet is arranged in the wall of the main building, from which water may be drawn for the requirements of these outbuildings.

In order to accustom the inhabitants to make use of water from the water supply, no restraint is laid on them by the installation of a water meter. A yearly payment of 75 cents for each dweller, excluding children, is taken from householders, who have water supplied to their premises. The consumption of water is not limited in any way at all.

SYSTEM OF THE WATER SUPPLY.

The Northern Dwina is the best source of water supply available for the town. The water is of excellent quality, being free from organic impurities. It is tasteless and odorless, but as the water shed is not free from swamps, the water has a slight yellow color. The water is free from hardness and answers favorably every practical demand for domestic use. American filters would have been the most suitable for such water, but on account of the prejudice on the part of the Municipal Council, filters of the English system had to be installed.

Analysis of filtered water gave the following results: 3° German hardness, no traces of either nitrates or nitrites, no ammonia or chlorine. Oxygen required to oxydize organic matter—per litre 14.9 milligrams. In 1 litre of water there were 4.7 milligrams sulphuric acid and in 1 cubic cm., 83 bacteria.

The pumping station is situated outside the town, a short distance up the river, and the pumps deliver water into the town by means of two main supply pipes. The water tower is located in the center of the town. During fires the tank is excluded from the system and by direct pumping the pressure is raised to 7 atmospheres. This pressure may be increased in case of necessity, as the street mains were tested at 10 atmospheres.

The whole installation consists of:

(1.) A stone engine house, roofed with sheet iron.

(2.) An English filter covered with arches, all built of bricks on cement.

(3.) A reservoir for filtered water, built of bricks on cement.

(4.) A stone water tower with an iron tank.

(5.) An electric signaling device.

(6.) A wooden building for employes.

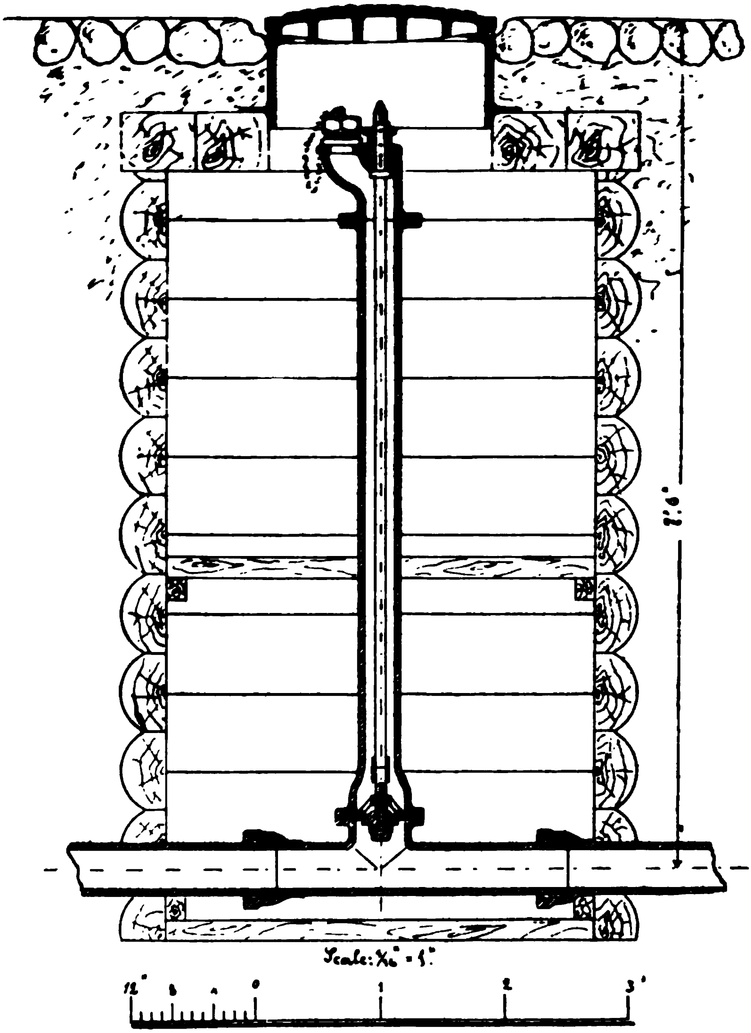
(7.) Eight public water supply stations.

(8.) Two steam pumps for river water and two similar pumps for filtered water.

(9.) Two steam boilers of the Cornwall type.

(10.) Street mains consisting of 6 and 4-inch pipes with fire hydrants and stop gates.

Fire hydrant.



ENGINE HOUSE.

The engine house is built outside the town at a distance of three-quarters of a mile up the river, first, because the river within the town boundary is fouled by the rinsing of codfish, the floating of rafts with pitch, etc., and second, because here the soil consists of clay, which reaches the surface and thus obviates the necessity for expensive pile foundations. The width of the river in this spot is equal to .6 English mile and its depth in some places reaches 78 feet. The distance from the center of the pumps to low water level is equal to 14 feet 9 inches. During the overflow of the river in spring the water rises not more than 12 feet.

The building is of brick and is 73 feet 4 inches long. 35 feet wide and 12 feet 10 inches high; it is covered with a sheet iron roof. The depth of the foundation is 8 feet 9 inches.

The pipe-lines leading to the engine are located directly under the floor and are easily accessible for inspection.

Drain pipes are laid from the engine and boiler rooms to the river.

The octagonal brick chimney is built 63 feet in height, with an interior diameter of 2 feet 6 inches at the base and 2 feet at the top.

FILTER.

The covered English filter, consisting of 5 compartments, is built on cement, earth being piled over it to a thickness of 3 feet to keep out the frost. The total filtering surface is 1,500 square feet.

It was necessary to put up with such a small capacity, owing to the fact of the town's means being limited.

Provision is made for the direct delivery of river water, without going through the filters, in the case of insufficiency of filtered water during large fires.

There has arisen no occasion up to the present time for giving the inhabitants unfiltered water.

In the springtime, during the time when the ice floats down the river, the water is fouled to a large extent with turf, and in view of this it is not allowed to enter directly into the filters, but is passed through a screened tank where the larger part of the dirt is retained. From this tank the water flows down through a 6-inch pipe into the filters.

The flow of water is regulated by means of gate-valves placed at the intake and outflow of each of the filtering compartments.

Floats indicate the speed of filtration.

There are ½-inch cocks for the purpose of taking samples of filtered water.

In winter the filters are heated with exhaust steam from the pumps

The bed of the filters is made up in the following manner:

I. Lowest layer, thickness 8 inches, cobble stones 200 mm. in diam.
II. Layer, thickness 6 inches, cobble stones 65 mm. in diam.
III. Layer, thickness 3 inches, stone 20 mm. in diam.
IV. Layer, thickness 2 inches, stone 12 mm. in diam.
V. Layer, thickness 2 inches, gravel 3½ mm. in diam.
VI. Layer, thickness 6 inches, sand 1½ mm. in diam.
VII. Layer, thickness 1 foot 6 inches, sand ¾ mm. in diam.

Thus the total depth of the filtering layers is equal to 3 feet 9 inches. The filters, when working normally, deliver 97,500 gallons of water in 24 hours, but during tests the speed of filtration was brought up to 195,000 gallons, the water thus filtered being fully suitable for household requirements.

The drainage of the filters consists of canals, constructed of bricks laid dry.

The ventilation pipes are placed in chess-board fashion.

The filters are cleaned every two or three days during the spring, but only every two months during the rest of the year.

A fresh layer of sand is added after every cleaning, so that the thickness of the filtering layer always remains the same.

BASIN FOR FILTERED WATER.

This is a round reservoir, covered with a dome, all built of brick on cement underground. The floor is of concrete as in the filters. The capacity of the basin equals 32.500 gallons. The water from the filters enters through a 6-inch pipe. An 8-inch suction pipe is laid to the pumps delivering water into the town. A shaft is arranged for purposes of inspection. In winter it is filled with straw, closed on the top by a cover, on which snow is heaped.

An unpleasant incident occurred during the erection of the basin. A pit for the basin was successfully dug out and the building of the walls had commenced when one day a heavy rain, such as rarely occurs in this locality, commenced. The earth wall fell in and filled up the pit. An octagonal wooden framework had to be made in order to render the completing of the brickwork possible.

WATER TOWER.

The building of a water tower was avoided in the following manner: There is a fire watch tower, 77 feet in height, in the center of the town, above the Police Office; the roof was taken off this tower and an iron tank 9 feet in diameter and 14 feet high was installed there. On putting up the tank the walls of the tower were raised 16 feet 4 inches and a roof with a fireman's watch-cabin was erected above the tank. The insignificant capacity of the tank, *i. e.*, 6,500 gallons, is due to the small dimensions and slight strength of the existing tower. The tank is of cylindrical shape and is composed of iron sheets ⅛ of an inch thick; it is painted on the inside with carbonizing coating of the Goheen Manufacturing Co., Canton, Ohio, U. S. A., and with red lead on the outside.

A 6-inch pipe delivers water into the tank and serves at the same time as a feed pipe for the town.

A 4-inch pipe is connected to the 6-inch overflow pipe for washing the tank.

The tower is situated at a distance of 2½ miles from the pumping station.

In the winter time the tower is heated and serves to dry the fire hose.

ELECTRIC SIGNALIZATION.

To record the level of the water in the tank at the pumping station a system of electric signals is arranged. An inductor is installed at the pumping station and four wires are directed from it to four floats, placed in the tank to indicate ¼, ½, ¾ and a full tank. Besides this an alarm signal is given by an automatic bell, when the pressure in the town system falls below 20 pounds.

BUILDING FOR EMPLOYES.

This building, intended for the engine room staff, is built of wood and roofed with sheet iron. It stands on a stone foundation and is 56 feet in length, 28 feet in width and 12 feet 3 inches in height. It is situated near the pumping station.

PUBLIC WATER SUPPLY STATIONS.

The public water supply stations, numbering eight in all, are built of wood; some of them were constructed on stone foundations, others on piles, as the quality of the soil permitted. They are located in different parts of the town and are intended principally for supplying water to the poor class. Each station is equipped with a 1½-inch wall outlet for taking water by means of barrels, and another 1-inch pipe for taking water with pails. The station consists of one room, which serves as a dwelling place for the watchman.

Water from these stations is given to holders of tickets, which are paid for or obtained gratis. These tickets are issued by the Municipal Board.

STEAM PUMPS.

Two sets of steam pumps are installed, one of which is in reserve. Two pumps with steam cylinders 7½ inches in diameter, pump piston equal to 8 inches and stroke of 16 inches, serve to deliver river water to the filters, and two others, the dimensions of which are 13x8x16 inches, deliver filtered water into the town. These pumps are of double action with fly-wheels, the water cylinder being of the Worthington type and the admission of steam by Meyer's slide valves, with expansion. The pistons are fixed on one general rod; the water pistons being fastened on one end and the steam piston on the other. Each pair of pumps has one general air chamber 1 foot 9 inches in diameter and 5 feet high.

The steam, suction, and part of the delivery pipes are located below the floor.

The pumps are able to deliver up to 16,000 U. S. gallons per hour. The suction pipes are 8 inches in diameter and the delivery is 6 inches. The intake pipe is laid at a distance of 280 feet from the engine-house and the top of the outer end of this pipe is 7 feet below the zero level of the river. The check-valve is situated on the bank in a separate well. In the case of the river pipe becoming choked up, it may be washed by reverse pressure. The laying of the suction pipe was performed in the following manner: Two rows of pontoons were put up in the river in such a way that a space of 3 feet was left between them. A scoop was used for digging the trench and two workmen pushed it into the soil. A rope was directed from the ladle to a winch and as the rope was wound the workmen with the ladle proceeded further. In this way a trench 3 feet 6 inches in depth was dug in the river ground.

The suction pipe was made up of 8-inch cast-iron socket pipes, which were connected with lead joints and adopted the outline of the river bed. After caulking, the whole line was tested at 10 atmospheres and gradually lowered down to the bottom of the river by means of winches.

The strainer and part of the pipe are surrounded with cobblestones, and as the flow of ice down the river is sometimes very powerful, the pipe is protected on the sides by piles.

STEAM BOILERS.

The steam boilers are of the horizontal Cornwall type with a heating surface of 250 square feet and for a pressure of 6 atmospheres. Two boilers were put up, one of which is reserve. The diameter of the boiler is 4 feet 6 inches, the diameter of the welded flue 2 feet 5 inches and the length 14 feet 9 inches. The thickness of the boiler plates is ⅜ inch and the front plates are ½ inch. The boilers are fed with filtered water by means of two injectors. The maximum and minimum water-levels are indicated by "Amphlet" whistles. The furnaces are arranged for wood.

STREET WATER SUPPLY SYSTEM AND FIRE SERVICE.

The street mains consist of 6 and 4-inch cast-iron pipes, coated with asphalt according to the system of Angus Smith and connected together by means of lead joints. The pipes are laid at a depth of 7 feet 6 inches. At both ends of the town the pipes are laid in clay soil and in the center part they are located in a swamp, so that the mains form a chain, fastened on both ends. As the marshy soil cannot serve as a steady basis for the pipes, the back-filling is made in such a manner that the weight of the earth should press on only part of the pipes.

This is attained by digging the trenches not as continuous ditches, but with intervals. Ditches of 14 feet in length have intervals of 4 feet between them and openings are made at the bottom of these earthen walls for the passage of the pipe. In covering the pipes the earth presses only on the pipes in the ditches and the spaces which were not dug up from earthern arches, these latter not producing any pressure on the pipes.

The water is delivered into the town by means of two 6-inch mains, surrounding the district of the poor class of inhabitants; in the central part of the town one 6-inch line is laid with two parallel 4-inch pipes and at the end of the town, where the population is less and where there is more free space, one 6-inch line and another 4-inch are laid. Cross mains are being laid as means are obtained.

Stop-gates are installed 1,700 feet apart; besides this there are two drain cocks. Hydrants for hose 2½ inches in diameter are located at intervals of 350 feet directly above the mains.

A red lantern is put up on the pavement opposite the hydrant, and as the streets are covered with a thick layer of snow in the winter time, a rope is made use of for finding the hydrant quickly; this rope being kept in the lamp-post, and in case of necessity it is stretched out up to a post placed on the opposite side of the street; a lead ball is fixed on the rope directly over the place where the hydrant is installed, so that it is easy to find the hydrant even in the dark. This fact is of special importance as the lighting of the streets in the winter time is fulfilled by snow and moon.

The fire signaling consists in watching from three towers, to see if any smoke and fire should appear on the exterior of some building. As no less than 5 to 10 minutes and sometimes more must elapse from the moment the fire starts until it breaks out on the exterior of a building, and taking into consideration that the drive of the brigade to the fire will require not less than 5 minutes, it is surprising that we have but little loss by fires.

Frequently the watchmen on the towers, especially during the night, doze, and sometimes simply fall asleep. It is necessary to have special men to keep control over them and these latter frequently also doze somewhere in a corner. In view of this, the man on duty has to be watched by the fire chief. Besides this, the maintenance of watch service on the tower involves considerable expense. If the watchmen on the towers in our town were abolished and electric fire signaling arranged, the expenditure for an installation of this kind would pay for itself in a period of four years.

The firemen are frequently changed and owing to the paltry salary, amounting to six or seven and one-half dollars per month, drunkards are almost exclusively taken on who have not the least idea about the construction of a hydrant.

Notwithstanding all this the maximum loss from fire for two years does not exceed $6,500.

COST OF LAYING 6-INCH PIPES.

Cost of 6-inch cast-iron pipe, per foot	$0.63
Cost of lead, per foot	.03
Laying, yarning, pouring, caulking	.06
Trenching, bell-holes, back-filling	.19
Total per foot	$0.91

COST OF LAYING 4-INCH PIPES.

Cost of 4-inch cast-iron pipe, per foot	$0.38
Cost of lead, per foot	.02
Laying, yarning, pouring, caulking	.05
Trenching, bell-holes, back-filling	.19
Total per foot	$0.64

APPENDIX A1.

TOTAL COST OF WORKS.

(1.) Engine house with chimney	$ 3,975.00
(2.) Filters with pipes, grates, etc	5,775.00
(3.) Reservoir for filtered water	1,040.00
(4.) Superstructure of water tower with tank, pipes and gates	1,500.00
(5.) Electric signalization from water tank to pumping station	750.00
(6.) Building for employes	1,000.00
(7.) Eight public water supply stations at $300.00	2,400.00
(8.) Four steam pumps with all the pipes inside the building, at $1,500.00	6,000.00
(9.) Two steam boilers at $1,250.00	2,500.00
(10.) Street water supply system:	
(a.) 6-inch cast-iron pipes, 30,198 feet, at $0.91	27,480.18
(b.) 4-inch cast-iron pipes, 18,962 feet, at $0.64	12,135.68
(c.) 98 hydrants at $48.00	4,704.00
(d.) 49 stop-gates at $40.00	1,960.00
(e.) Two drain-cocks and 1 air valve	110.00
Total	$71,329.86

APPENDIX A2.

EXTRACT FROM ORDINANCE RELATING TO THE WATER DEPARTMENT.

(1.) If the premises, in which it is desired to have water service, are located in a street not having a water supply main and are more than 100 feet distant from the nearest main, then a cast-iron street main must be laid along the street. If the distance to the main is less than 100 feet, then the laying of an iron pipe of small size is permitted.

The laying of the street mains is done by the city employes at the expense of the owner of the building, on condition that the municipality undertakes to pay back these expenses with water, *i. e.*, the payment of schedule rates is not taken until the whole amount invested by the owner is covered by such deductions.

In case of branch pipes being directed from such a main to the neighbor's, these latter must pay an amount proportional to the previous cost, and this money is used to cover the expenses incurred by those who paid the amount for the laying of the street main primarily.

(2.) Our practice is to tap the main and lay the service pipe to the curb box at the expense of the owner of the building.

Galvanized iron pipes not less than 1 inch in diameter have to be used, and for sizes of 3 inches and more, cast-iron ones.

The consumer agrees not to supply water to neighbors or allow them to take it, also that water will not be allowed to run to prevent freezing.

(3.) If the owner and the occupant of the premises in which water is used fail to keep the pipes and the fixtures in good order. the water shall be cut off until the waste is stopped.

(4.) All service pipes shall be laid by the municipality and repaired at the expense of the city.

APPENDIX A3.

SCHEDULE OF WATER RATES.

(1.) The annual rate for water is fixed as follows:	
(a.) For each consumer (excl. children)	75 cents
(b.) For a water closet, additional	62½ cents
(c.) For a bath tub, additional	62½ cents
No payment is taken for children younger than 10 years.	
(d.) For each horse or cow	75 cents
(2.) From schools, for each 1,000 vedros (3,250 gals.)	50 cents
(3.) For industrial purposes, if the daily water consumption exceeds 3,000 vedros, for each 1,000 vedros	62½ cents
If the consumption is less than 3,000 vedros, for each 1,000 vedros	75 cents
(4.) Payment at the public water supply stations:	
(a.) Per barrel at 40 vedros (130 gallons)	2½ cents
(b.) Per tub at 4 vedros (oushat)	¼ cent
(c.) Per vedro (3.25 gallons)	1-16 cent

To the poor class presenting tickets, which are distributed by the municipality, water is given free of charge.

APPENDIX A4.

SUMMARY OF STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1905.

Population	13,000
Date of construction	1903
By whom owned	City of Archangel, Russia
Source of supply	Northern Dwina
Mode of supply	Pumping

PUMPING.

(1.) Builders of pumping machinery	D. Linowieff & Co., Narva, Russia
(2.) Fuel used	Wood
(3.) Total pumpage of filtered water for the year in gallons, without allowance for slip	31,741,460
Cost of pumping, figured on pumping station expenses, viz.	$4,408.00
(4.) Per million gallons pumped	139.05
Cost of pumping, figured on total maintenance, viz.	$9,824.00
(5.) Per million gallons pumped	$309.90

FINANCIAL STATEMENT

Receipts		Expenditures	
A. Water rates	[illegible]	A. A. Management and repairs	[illegible]
B. From other sources	[illegible]	B. B. Interest and payment of bonds	[illegible]
Total	[illegible]	C. C. Extension of mains	[illegible]
Balance	[illegible]	D. D. Extension of services	[illegible]
Total	[illegible]	Total	[illegible]

Net cost of works to date [illegible]

CONSUMPTION

(1.) Estimated population at date [illegible]
(2.) Total pumpage for the year in gallons [illegible]
(3.) Feed water [illegible]
(4.) Total consumption for the year [illegible]
(5.) Passed through meters (excl. feed water) [illegible]
(6.) Average daily consumption in gallons [illegible]
(7.) Percentage of consumption metered [illegible] per cent
(8.) Gallons per day to each inhabitant [illegible]
(9.) Gallons per day to each tap [illegible]

MAINS.

(1.) Kind of pipe..Cast-iron
(2.) Sizes..From 4 to 6 inches
(3.) Extended during year..1,500 feet
(4.) Total now in use..8¾ miles
(5.) Cost of repairs per mile..$9.35
(6.) Number of leaks per mile..⅔
(7.) Number of hydrants now in use..98
(8.) Number of stop-gates now in use..48
(9.) Range of domestic pressure on mains..39 to 47 lbs.
(10.) Fire pressure..7 atmospheres

SERVICES.

(1.) Kind of pipe..Galvanized iron and cast-iron
(2.) Sizes..1 inch to 3 inches
(3.) Number of service taps now in use..475
(4.) Average length of service..35 feet
(5.) Number of meters now in use..5

APPENDIX A5.

STANDARD METRIC ASSORTMENT OF CAST-IRON WATER SUPPLY PIPES COMPUTED BY THE COMMITTEE OF THE FIVE—RUSSIAN WATERWORKS CONVENTION OF THE YEAR 1901.

WORKING DRAWING.

The standard assortment is based on a strictly metric basis, *i. e.*, the sizes of the pipe diameters correspond with the character of the system and are not attained by transferring inches into millimetres multiplying by 25.

The number of types of pipes in the standard assortment is considerably less than in the German standards, in view of which fact the interests of the producers as well as of the users are looked after; an excess number of types, on the one hand, overburdens the pattern stores at the works, and on the other the stores of special castings of the users.

Success of technical art in the foundry business has made possible the establishment of the thickness of pipe shells for pipes from 40 to 3,000 mm in diameter, according to the formula d=.02D+6.5 mm and for pipes from 350 to 1,200 mm in diameter according to d=.02D+6 mm.

COMPARATIVE THICKNESS OF METAL IN THE BODY OF THE PIPE OF STANDARD RUSSIAN AND GERMAN ASSORTMENTS.

Inside Diameter D	Thickness of Pipe Shell δ		Inside Diameter D	Thickness of Pipe Shell δ		Inside Diameter D	Thickness of Pipe Shell δ	
	Russian Assortment	German Assortment		Russian Assortment	German Assortment		Russian Assortment	German Assortment
40	7.5	8	225	11	11.5	700	20	19
50	7.5	8	250	11 5	12	750	21	20
75	8	8.5	300	12 5	13	800	22	21
100	8.5	9	350	13	14	900	24	22.5
125	9	9.5	400	14	14.5	1000	26	24
150	9.5	10	450	15	15	1200	30	28
175	10	10 5	500	16	16	......	......	.....
200	10 5	11	600	18	17	......	......	......

The variations of the thickness of the pipe shells of the two assortments are shown in the next figure.

(Figure Tracing.)

In determining the thickness of the pipe shell, it is impossible to base the calculations on the theoretical figures exclusively, it being necessary to consider combinations of practical character, *i. e.*, the possibility of casting a pipe of a determined thickness correctly, the convenience of transporting and laying, the effect of rust, etc.

If the pipe is considered as a hollow cylinder with internal pressure (Bach, Details of Machines, page 31, edition of 1897), we obtain the term for the exterior radius r_a

$r_a = r_i \sqrt{\frac{K_z + .4\,P_i}{K_z - 1.3\,P_i}}$, where K_z is the tensile stress

P_i — interior pressure

r_i — interior radius of pipe.

Accepting $K_z = 200$ kilagr. per square cm., and $P_i = 10$ kilagr. per square cm. $r_a = 1.044\,r_i$

$\delta = r_a - r_i = .044\,r_i = .022D$ (D interior diameter of pipe), but in view of the above mentioned reason, this theoretical formula reverts into an empirical one of common form $\delta - f\,(K, P_i, D) + C$, where C depends on the technical art of the foundry business, convenience of transport, etc. The amount C may be looked upon as the sum of three items: C_1 (allowance for imperfect casting), C_2 (allowance for rusting) and C_3 (allowance for purposes of handling and transportation).

$$C = C_1 + C_2 + C_3$$

C_1 may be decreased as the exactness of casting has increased.

C_2 may be considered almost equal to naught; water supply pipes, asphalted according to Angus Smith's system, as proved experimentally by W. Lindley, are not subject to rust and have a surface quite as smooth as when they were laid in the ground twenty years ago.

C_3 may likewise be decreased partly, owing to the fact that the standard pipes now offered, being thicker on their ends, are more safe from damage in transport.

Having regard to the aforesaid consideration the amount C, when computing the standard Russian assortment, was accepted at 6 and 6½ mm.

In making the outline of the socket, it is needful to maintain fluency of the bends from the thin places to the thick ones, as otherwise it will not be possible to attain an even distribution of material in casting.

The socket must give, on the one hand, flexibility in the joint, and, on the other, guarantee tightness of the connection. These two demands are not satisfied by a deep socket which always decreases the flexibility of the pipe line; besides this, more material is required for the joints when a deeper socket is used. Having regard to this, the depth of the socket is determined according to formula $l = 60 + .04D$.

The length of the transition of the shell into the socket —f, is determined according to formula —$f = 60 + .06D$.

The other sizes for outlining the socket are shown on the working drawing.

The length of the socket pipes is accepted as follows:

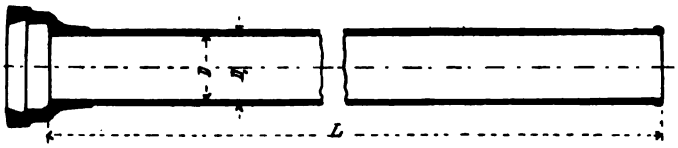
For diameters of 40 to 50mm—2 metres.
For diameters of 75 to 300mm—3 metres.
For diameters of 350 to 1200mm—3.75 metres.

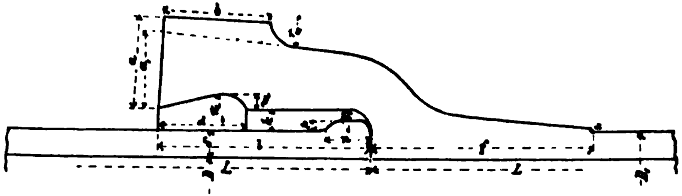
The casting of straight pipes of standard length is vertical, without lengthwise seams and with the socket downwards.

The thickness of special castings is increased 20 per cent. as compared with the standard thickness of the pipe, as the specials are cast horizontally, it being difficult to attain an even thickness of the shell with such a method of casting.

APPENDIX A6.

STANDARD CAST-IRON BELL AND SPIGOT PIPE.





Inside diameter D	Outside diameter D_1	Thickness δ	Depth of bell l	Length of the transition of the pipe into the socket f	Thickness of lead joint K	Thickness of the socket at its end a	Auxiliary size for drawing the socket a_1	Depth of lead joint d	Interior swelling of lead joint m	Width of the rim of the socket C	Height of the recess where the pipe passes into the socket t	Height of spigot p	Width of spigot n	Length of pipe L	Weight: Pipe without socket and spigot	Weight: Socket	Weight: Pipe with socket and spigot	Weight: Lineal metre of pipe with socket and spigot	Inside diameter D
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg	kg	kg	mm
[40]	[55]	[7.5]	[62]	63]	[7]	[26]	[21.5]	[26]	[4.5]	[31]	[1]	[3.5]	[14]	[2000]	[16.23]	[3.22]	[19.50]	(9.75)	(40)
50	65	7.5	62	63	7	26	22	26	4.5	31	1	3.5	14	2000	19.65	3.64	23.35	11.68	50
[75]	[91]	[8]	[63]	[65]	[7]	[27]	[23]	[26.5]	[4.5]	[31.5]	[1]	[3.5]	[14]	[3000]	[45.37]	[4.93]	[50.39]	(16.77)	(75)
100	117	8.5	64	66	7	28	23.5	27	4.5	32	1	3.5	14	3000	63.02	6.44	69.57	23.19	100
125	143	9	65	67.5	7	29	24.5	27.5	4.5	32.5	1	3.5	14	3000	82.41	7.94	90.48	30.16	125
150	169	9.5	66	69	7.5	30	25.5	28	4.5	33	1	4	15	3000	103.54	9.62	113.35	37.78	150
[175]	[195]	[10]	[67]	[70.5]	[7.5]	[31]	[26]	[28.5]	[5]	[33.5]	[1]	[4]	[15]	[3000]	[126.41]	[11.64]	[138.27]	(46.09)	(175)
200	221	10.5	68	72	7.5	32	27	29	5	34	1	4	15	3000	151.03	13.67	164.95	54.98	200
[225]	[247]	[11]	[69]	[73.5]	[8]	[33]	[28]	[29.5]	[5]	[34.5]	[1]	[4]	[16]	[3000]	[177.39]	[15.99]	[193.68]	(64.50)	(225)
250	273	11.5	70	75	8	34	29	30	5	35	1	4	16	3000	205.49	17.93	223.75	74.58	250
300	325	12.5	72	78	8.5	36	30.5	31	5	36	1.5	4.5	17	3000	266.92	23.27	290.67	96.89	300
350	376	13	74	81	9	38	32.5	32	5.5	37	1.5	4.5	18	3750	402.99	29.39	432.95	115.45	350
400	428	14	76	84	9	40	34	33	5.5	38	1.5	5	18	3750	494.95	35.96	531.62	141.77	400
450	480	15	78	87	9.5	42	36	34	5.5	39	1.5	5	19	3750	595.65	43.89	640.40	170.78	450
500	532	16	80	90	10	44	37.5	35	5.5	40	1.5	5	20	3750	705.06	52.29	758.35	202.23	500
600	636	18	84	96	11	48	41	37	6	42	2	5.5	21	3750	949.97	73.06	1024.41	273.18	600
700	740	20	88	102	11.5	52	44.5	39	6.5	44	2	6	23	3750	1229.73	95.59	1327.22	353.93	700
[750]	[792]	[21]	[90]	[105]	[12]	[54]	[46]	[40]	[6.5]	[45]	[2]	[6]	[24]	[3750]	[1382.72]	[111.26]	[1496.14]	(398.96)	(750)
800	844	22	92	108	12.5	56	48	41	6.5	46	2.5	6.5	24	3750	1544.36	124.51	1671.30	445.69	800
900	948	24	96	114	13	60	51.5	43	7	48	2.5	7	26	3750	1894.10	156.57	2053.89	547.70	900
1000	1052	26	100	120	14	64	55	45	7	50	2.5	7	27	3750	2278.07	196.45	2478.25	660.87	1000
1200	1260	30	108	132	15.5	72	62	49	7.5	54	3	8	30	3750	3151.20	287.31	3444.11	918.43	1200

Remark: The placing of diam. of pipes in brackets signifies that they are used temporarily.

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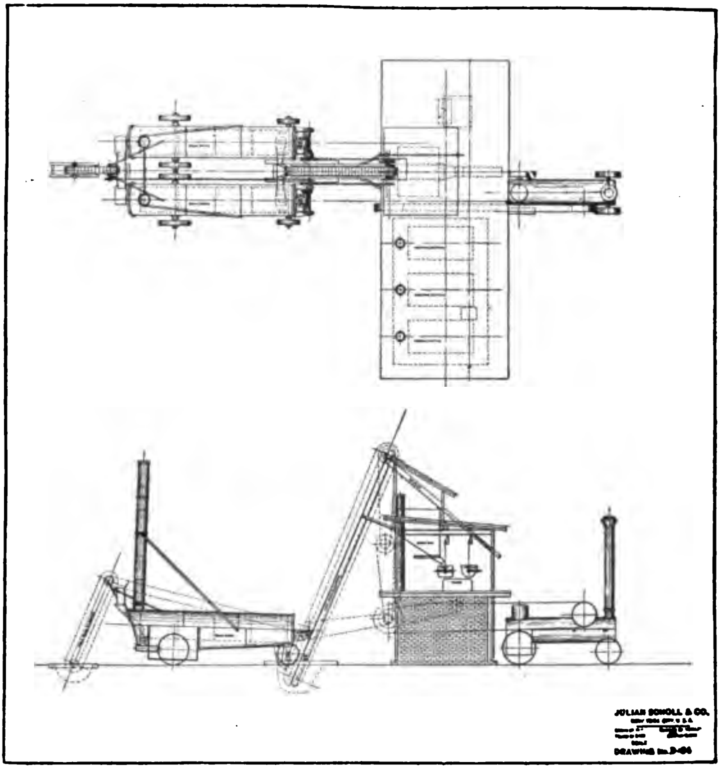
MUNICIPAL ASPHALT PLANTS



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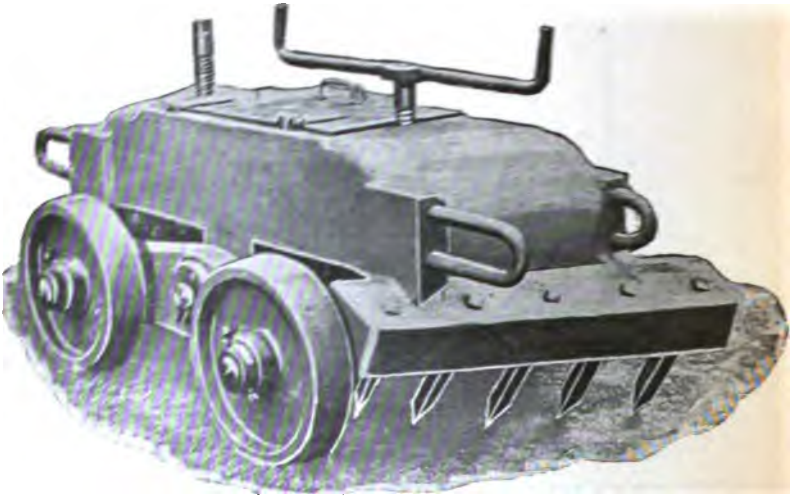

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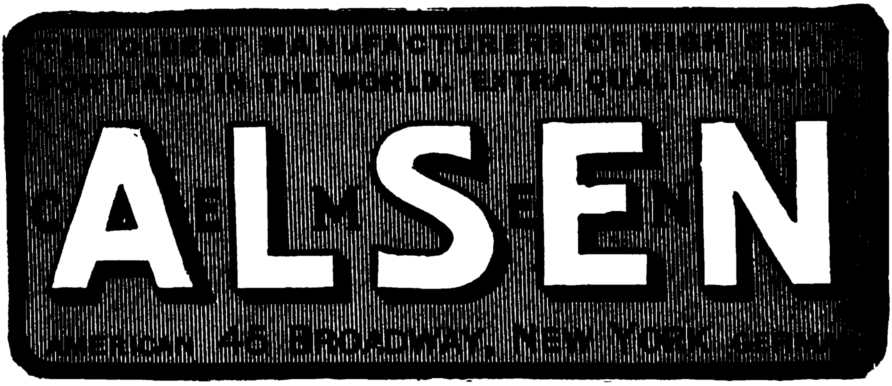
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